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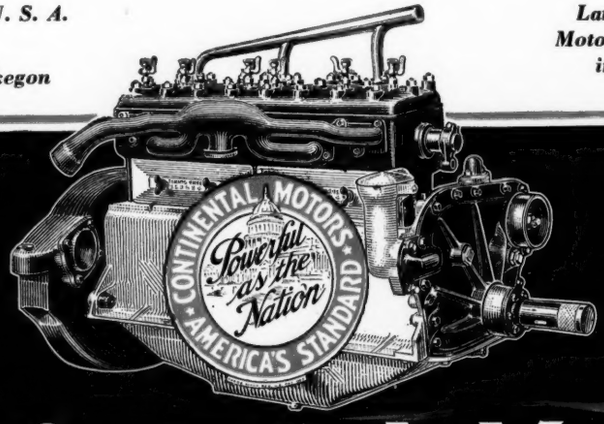

Continental Motors

AUTOMOTIVE INDUSTRIES
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More Definite Planning Needed In Market Study

Passenger car manufacturers are interested in market analysis, but plans frequently lack definite objective. Recent survey shows what is being done, and gives basis for evaluation of methods. Maximum use not obtained from much of data collected.

By Norman G. Shidle

AUTOMOBILE manufacturers are thoroughly awake to the necessity for market analysis. A study of sales possibilities is being carried on by manufacturers of cars in every price class. The work has been going on for so short a time, however, in a majority of cases that methods of procedure are in a primary state. Speaking generally, such work was not undertaken until an absolute necessity arose for it.

While there are varying opinions as regards the usefulness of certain types of market analysis data, very great interest in the general problem is being evinced in every plant. High executives are looking for data of any kind that bears upon the subject, and are scanning carefully whatever material they can obtain.

In a few cases a study of marketing problems was begun a little before such study became absolutely necessary. Some companies began it, as soon as the necessity first began to appear in concrete form a year and a half or two years ago. In most cases, however, serious work has been going on for only a few months, while in the case of one company it is just starting at the present time. These are the outstanding features of a personal survey just completed among representative passenger car companies.

There is no better time than the present at which to take stock of methods and purposes; to evaluate the tendencies in the work which has been done and to determine the proper bases for such work, together with the best methods of procedure viewed from a practical standpoint.

It is unnecessary to point out the need for a study of markets and marketing costs. The necessities along this line have been emphasized frequently. Under present conditions the automobile business cannot hope to go forward successfully without a more accurate knowledge of individual market possibilities, a more accurate basis for the adjustment of quotas, a better possibility of predetermining the number of sales which may reasonably be expected and balancing more closely sales and production plans.

These facts are pretty well recognized by executives throughout the industry.

There is a strong indication, however, that much of the market analysis work in progress is being conducted without a sufficiently definite purpose. There has not been enough planning before the collection of data was begun. Frequently, the appearance of some data bearing upon marketing problems has aroused interest and led to the collection of more data along the same lines. A company has sometimes been sold a subscription to a statistical service without knowing beforehand just what use is going to be made of it.

The offering of the service suggests possible sales plans, rather than sales plans demanding the service.

Then, having subscribed to the service, an attempt has been made to find out just how it might be used to the best advantage. This seems to have occurred in a number of cases, the statistical service being of considerable value *per se*, but not being utilized to the fullest extent in correlation with other data bearing on the same problem. This is the natural result of a failure to lay out a broad and definite objective in the beginning. It amounts to trying to build the superstructure of a building before the foundation has been laid.

Sometimes this difficulty has even gone so far as the establishment of elaborate research and statistical departments, authorized to collect data of various kinds. In one instance such a department was operated for over a year and collected a vast amount of statistical data. Then the department was discontinued because none of the executives found practical use for most of the data gathered. A somewhat similar experience has occurred in one or two other instances. In each case the fault was not with the type of data gathered, but with the failure to determine beforehand what the function of the data was to be.

To solve the practical problems of the individual company, market study must be approached from two viewpoints:

1. A fundamental plan, including:
   - A. The definite purpose of the analysis.
     - a. A determination of the market for the given car which may reasonably be expected by territories for the next few years.
     - b. A correlation of these results with production, financing and administrative planning.
   - B. A list of all the factors bearing on this market.
   - C. The relative importance or relation between these factors as regards the market of reasonable expectancy for the given car.
   - D. A survey of sources of accurate and comprehensive data concerning each of the factors listed.
2. The immediate plan:
   - A. The practical problems that demand immediate solution; quotas of some kind must be set at once on some basis, etc.
   - B. Take immediate action on the basis of whatever data are already available, basing judgment as to the best present action, however, on the ultimate necessities of the fundamental plan.

Immediate action of some kind is necessary in most cases. The laying out of the basis of the fundamental plan, however, need consume only a few days of concentrated thinking on the part of a capable executive. This having been done, whatever immediate action is taken can be so built up that it will ultimately fit into the more comprehensive plan.

Having laid down the outlines of the broad plan, the sales executive can probably turn over to his research or statistical man the task of seeking out the available sources of information and of procuring the data necessary to fill in with concrete figures and facts the fundamental picture already drawn. If this is done, there is no waste effort. Data are sought for and collected with a definite aim in view. When it has been gathered, its function has been predetermined and it is automatically put to the use for which it was collected.

The answer to the problem under discussion will never be reduced to a mathematical exactness. That is obvious. Data concerning certain economic and psychological factors affecting the problem can never be said to be mathematically exact. It is possible, however, by analyzing statistically the sources and information available to come much closer to accuracy than has been done in the past.

Moreover, the picture under discussion is a constantly changing one. Whatever formulæ are developed, whatever methods of procedure are determined upon must take into account the fact that the data to be used will be in a constant state of flux. It is not enough to get a picture of the situation at any given moment. The development of the automotive industry is a dynamic, not a static, factor.

There is much material concerning sales and marketing questions now being collected by the various passenger car companies. Some of these data concern general matters of territorial analysis, competition, etc. Some of it relates to conditions of individual distributors and dealers in the particular organization. Nearly all of these data is being used to some extent. But it may be seriously doubted as to whether or not maximum use is being made of it. Each bit of information is being put to a good use in itself, but the relation between the various units does not always seem clear. The various units are not welded together to give a comprehensive picture.

A DEFINITE marketing plan should determine what data are to be collected and what use is to be made of that data. In certain instances the practice has been just the reverse. The result is considerable waste effort.

The chief necessity in most companies is for a more definite fundamental plan, a more comprehensive correlation of data, and a more detailed analysis of the factors involved in marketing studies.

This article is the result of a personal survey of representative passenger car plants. Following articles will discuss current practice in detail.

Thus far this discussion has been based on the assumption that every company is seeking to know its market of reasonable expectancy and to produce cars on that basis. This is not always the case. In certain instances there is still a tendency to make production capacity the chief gage of what production shall be. This results very frequently, in times like the present, in a production somewhat larger than the reasonable expectancy, with a consequent forcing of cars.

One company, for example, had its production department set the production schedule for 1922 without consulting the sales department. It is now up to the sales department to get rid of the production set. In such a case, it is obviously necessary to base distributors' quotas fundamentally upon this production schedule, regardless of the results of market analysis.

The chief necessity in most of the companies is for a more definite fundamental plan, a more comprehensive correlation of data, and a more detailed analysis of the factors involved in marketing studies.

The work of laying out in detail the outline plan should fall on the shoulders of the general sales manager or some other important executive. It should never be necessary for a research department to sell its ideas concerning market analysis to the general sales manager or other executives. The problems involved are more vital to the permanent growth of the individual firm than any others presented to-day. Careful study and analytical thought are necessary.

The present article has simply attempted to visualize the situation as it stands and to point out probable trends in development.

In following articles the establishment of quotas will be discussed in more detail. The practice of a number of representative passenger car plants will be cited and a general picture of what the industry is doing will be presented.

A Good Example of Modern Engine Design

New model of Buda engine is designed for light commercial trucks and similar applications, but is of heavy duty type and similar in general design to other engines of the same make. Compression ratio is 4.35 to 1. Special attention is given to securing water circulation around the valves.

By J. Edward Schipper

THE Buda Company has added to its line a new engine, which is typical in general construction of other engines of the same series, except that it is a smaller model. It is a heavy-duty, high speed type designed for light commercial or other use where a four-cylinder, 3⅝ by 5⅛ in. engine is applicable.

The four L-head cylinders are cast in block, with the cylinder head and the upper and lower halves of the crankcase cast separately. The two crankcase castings are iron and are divided horizontally. The engines are designed for three-point suspension with the rear supporting arm cast integrally with the upper half of the crankcase and arranged for main frame support. The forward end of the engine is supported at the crank center by a trunnion bracket arranged to rest upon a drop cross-member of the frame.

An idea of the general characteristics of this engine may be gained from the fact that it is a rather high compression type for a heavy duty engine having a compression pressure of 94.7 lb. per sq. in. absolute, or 80 lb. gage. The compression ratio is 4.35 to 1. There has been no attempt, however, to make an extremely high speed engine of this model, but to give it the moderately high speed characteristics which are necessary in light commercial work. The weight of the piston and connecting rod assembly is 7 lb. 3½ oz., the weight of the piston alone being 2 lb. 14 oz. The design has been worked out to be clean and dust-proof as well as accessible.

Cylinder Block

The cylinder block is provided with large water jacket space which is baffled so that the water is discharged directly beneath the valves and is designed to secure circulation around each valve. The spark plugs are located in the cylinder head, the threaded part of the spark plug in contact with the head being entirely surrounded by water. The water outlet on the cylinder head is fitted with a removable elbow which can be placed in four different positions. In fact, the entire engine has been laid out to be as universal as possible in its installation. One factor which may be mentioned from an accessibility standpoint is that the cylinder head is provided with a ledge projecting beyond the block which makes it possible to remove the head without damaging the gasket, and, at the same time, with a saving of considerable time. Lugs on each end of the cylinder and head are provided for breaking the joint in removing.

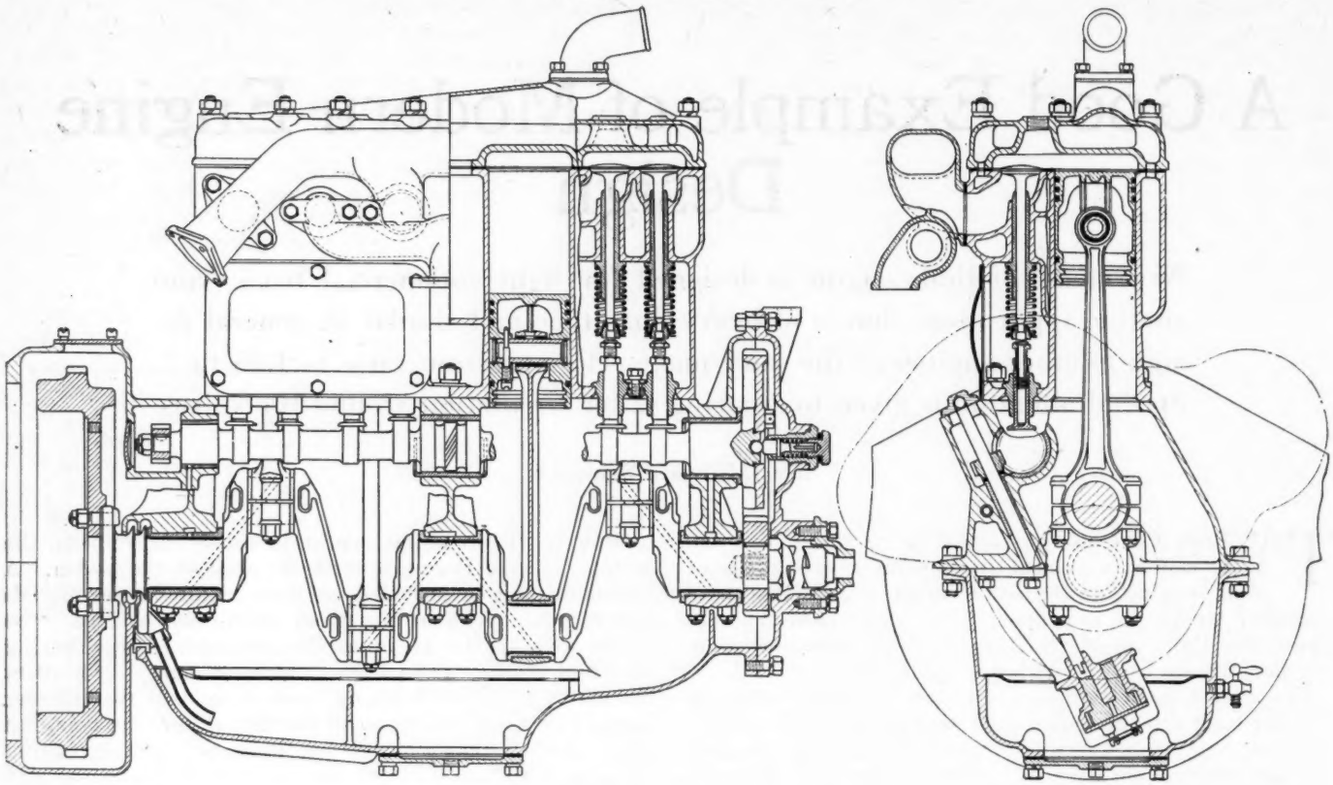
The grey iron pistons are fitted with concentric rings above the wrist pin and one wiper ring in the lower part of the skirt. The piston heads have cooling ribs to dissipate the heat and in manufacture the pistons are so located in the reaming operation as to insure that the piston pin hole is square with the wall of the piston. A balancing pad is provided on each piston to permit the piston to be machined to a given weight and balance. The piston pins are 1 1/16 in. in diameter and have a bearing length of 1⅞ in. The pistons are 4½ in. long. To prevent the piston pin from working through against the cylinder barrel there are two locks on the piston pin, one being an alloy steel lock screw with two diameters and extending through both sides of the pin to give double shear and prevent improper fitting of the pin at any time. The second is a spring retainer ring which expands in grooves turned in each end of the piston bosses.

Crankshaft Construction

Drop-forged, I-beam connecting rods are used without offset. The upper ends are fitted with phosphor bronze bushings and the lower ends with bronze-shell bearings lined with babbitt. Two connecting rod bolts of alloy steel secure each bearing cap. The crankshaft is drop-forged from open hearth steel and is given a machine balance. Due to the heat treatment employed, the tensile strength of the crankshaft is upwards of 120,000 lb. per sq. in., and the elastic limit 85,000 lb. per sq. in. The rear end of the shaft is fitted with two oil throwers to prevent leakage at that point. The bearing dimensions, front to rear, are 1¾ by 2½, 2 by 2½ and 2⅛ by 3 in. diameter and length. The connecting rod bearings are 1⅞ by 2 in. diameter and length. The connecting rod length is 11¼ in. center to center.

Helical gears of wide face are used to drive the camshaft and auxiliary units. Special equipment has been installed in the Buda factory for the machining of these timing gears which are cut on automatic hobbing machines. Particular attention is paid to the gear centers in order to secure quietness. The timing gearsets include the crankshaft, camshaft, idler and pump shaft gears. Also, the generator shaft gear when the generator is used. This is optional with the purchaser. The gears are accessible upon removal of the timing gearcase cover at the front end of the engine.

The camshaft is a one-piece drop-forging of open hearth steel, machined and case hardened. The working surfaces of the cams and the three camshaft bearings are given a ground finish. The valves are driven through mushroom type pushrods which are fitted with removable guides. The pushrods are made large to permit the use of large diameter adjusting screws, as well as to maintain correct alignment. The heads of the adjusting screws are fitted with oil-hardened steel blocks to facilitate alignment and eliminate warpage caused by case hardening. The large



Part sectional views of new Buda engine

bearing area at this point also permits of low unit pressure at the adjustment and consequently minimizes wear. Single piece, interchangeable chromium steel valves are employed both for inlet and exhaust. The valves have an effective working diameter of 1½ in. They are closed by barrel type, self-centering valve springs designed to eliminate side thrust upon the valve stems. The lower end of the valve spring and valve spring cup is held fast by a split type wedge grip valve spring retainer lock. This lock permits no movement up or down and is claimed to eliminate wear both on the lock and the groove in the end of the valve stem. To facilitate removal and permit adjustment of the valve tappets, the cover is split into two sections.

Cooling System

Pump water circulation is used, the centrifugal pump having a bronze runner and large packing glands. Bronze sleeves are fitted over the pump shaft to prevent rusting and pitting and the pump is made up as one assembly unit so that the water pump and its driveshaft can be removed as a unit or separately. The engine can also be arranged to use thermo-syphon circulation if desired. The fan is not furnished with the engine.

Full pressure feed lubrication provides oil for the crankshaft, camshaft bearings and connecting rod bearings. Oil is forced to the main bearings and camshaft bearings through a seamless steel distributing tube which is cast in the crankcase. From the main bearings the oil reaches the connecting rod bearings through passages drilled in the crankshaft. A pressure regulating valve is provided, the oil being pumped from the oil reservoir, which is located beneath the crankcase, by a geared pump located in the center of the oil reservoir and attached to the upper half of the crankcase to make it independent of the oil pan. The pistons and cylinders are lubricated by oil thrown from the lower ends of the connecting rods, while the timing gears are fed positively from the pressure system. The extra wiper ring on the lower end of the piston is designed to prevent an excess of oil reaching the combustion chamber. There is a settling chamber for sediment in the bottom of the reservoir below the oil pump, from whence it can be drawn off from time to time.

The intake and exhaust manifolds are of grey iron cast integrally. Two types are provided, one giving a combination intake and exhaust manifold for gasoline and a special combination design provided for kerosene. The exhaust outlet is fitted with an expansion joint and the manifolds are placed on the valve side of the engine.

Regarding accessories, provision has been made for attaching starting and lighting equipment and for ignition by a magneto driven from the end of the water pump shaft or battery ignition by timer which can be mounted on the water pump driveshaft housing. A governor pedestal mounted behind the rear cylinder carries a vertical shaft driven by the camshaft. All of the accessories can be readily reached and detached. The engine complete weighs 646 lb. with flywheel.

New Oil-Proof Felt Washer

AN oil-proof washer for use on shafting protruding from machinery casings on automobiles, etc., has been perfected by the American Felt Co. It consists of two layers of felt with a layer of a patented compound between.

It is claimed that this laminated washer, after many months of tests in axle housings and other places, has proved to be an effective dam in stopping oil seepage and leakage, and has been used successfully in two other industries, the laundry and the bakery machine industries. In laundry machinery this washer is said to have proved an effective preventative against oil leaking into the vats, and in bakery machinery it prevents oil from leaking into flour and mixing vats. Oil leakage is very annoying, especially in connection with the rear axles, and it is to be hoped that this washer may prove the remedy for this trouble.

German Car of Novel Design Employs Many Aluminum Parts

Uses a six-cylinder, 2.44 by 5.51 in., aluminum alloy engine with thin steel liners cast in the block. The outstanding features are an automatic gear-shift, and rear axle housing casting and pistons of silumin. Although the chassis has a 137 in. wheel base it is said to weigh only 1870 pounds.

By Benno R. Dierfeld

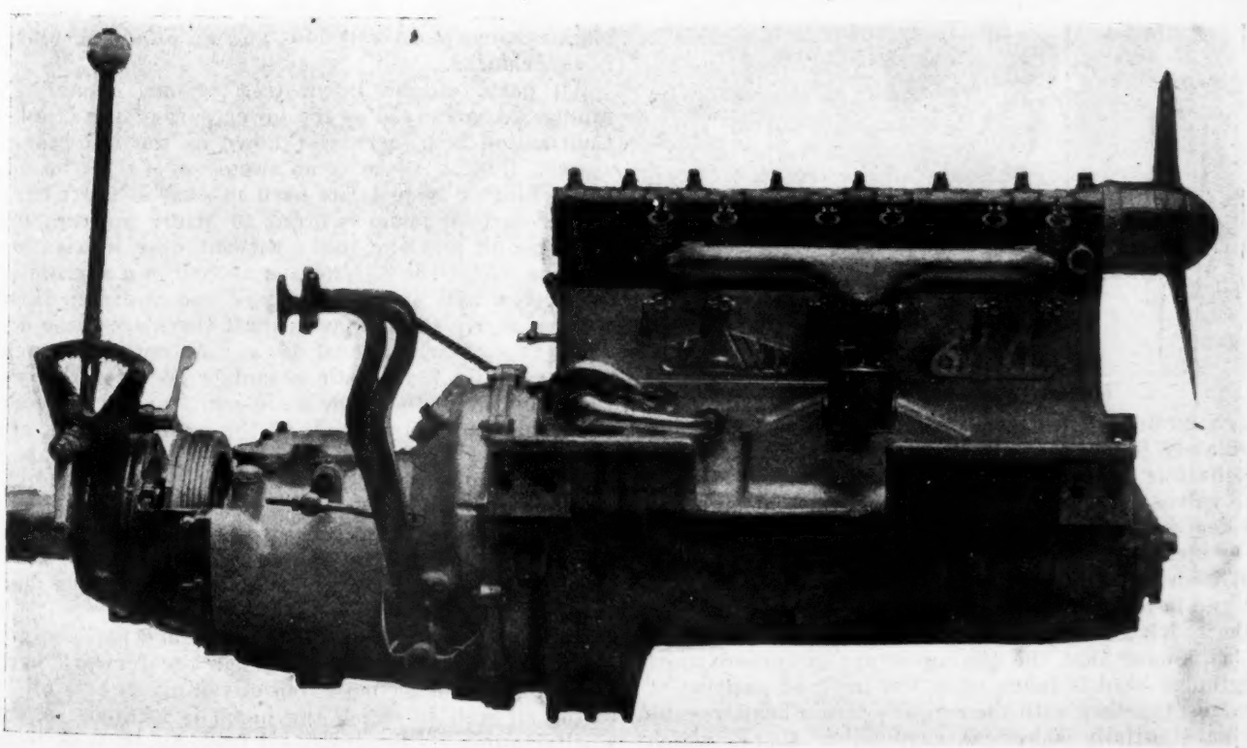
THE Szawe, a high-powered, quality car built principally for export trade, is the product of the firm of Szabo & Wechselmann of Berlin. It was designed by Dr. Bergmann, a consulting engineer, formerly chief designer of the Bayerische Motoren-Werke and the N. A. G. It is claimed to be the first German car into the construction of which light alloys enter to a large extent.

The chassis is laid out to meet fully the requirements of body builders. As will be seen from the views of the chassis, the side members of the frame are straight from end to end, there being no insweep at the front. All of the mechanical parts behind the dash lie beneath the top plane of the frame, so that there is a plane surface, bounded by straight lines, for the body builder to work on. The front springs are semi-elliptic, while the rear springs are of the cantilever type and of great length, which results in an unusual length of frame (110 in.) back of the dash.

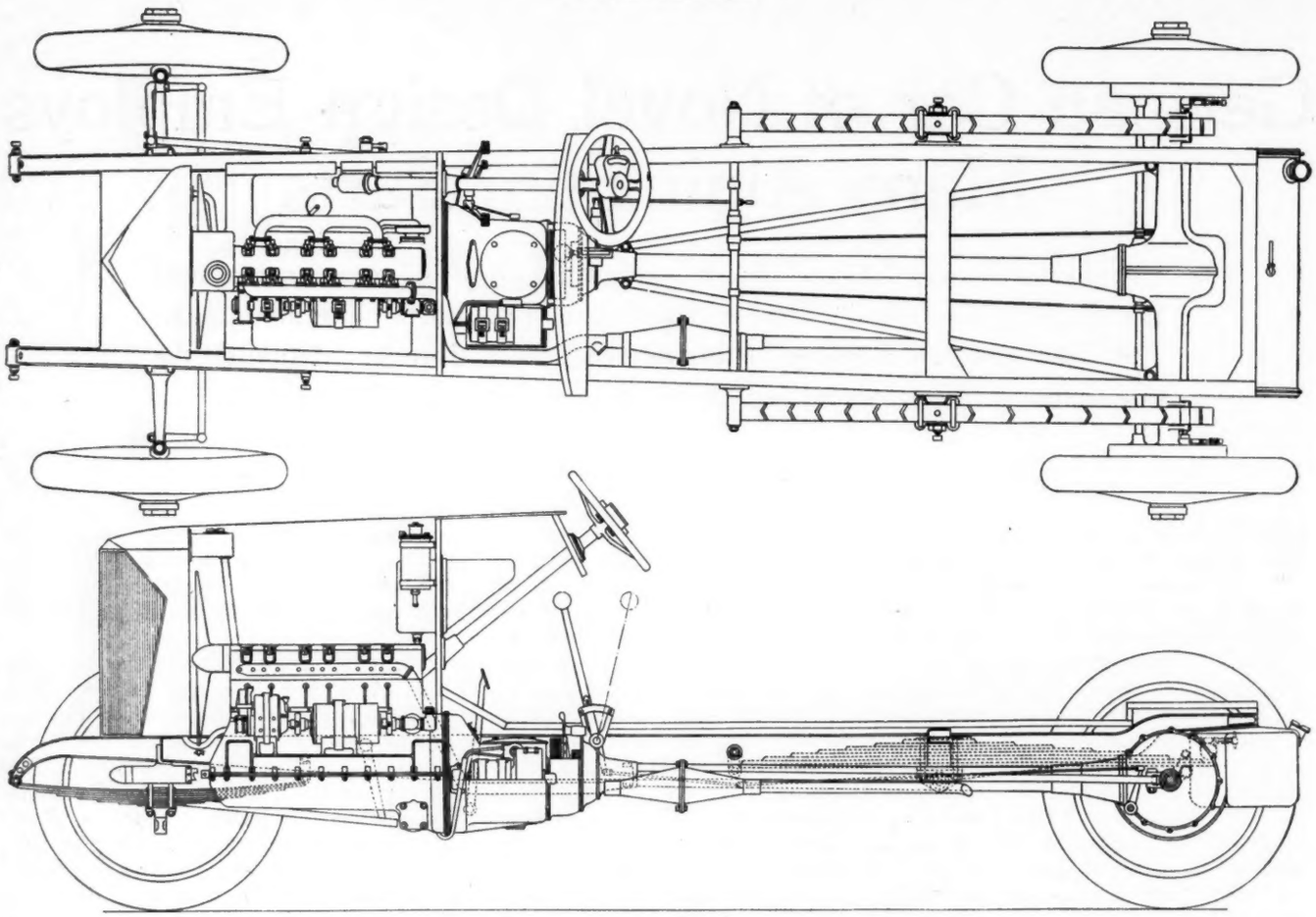
The cylinders and top part of the crank case are cast as a unit in a block of silumin, an alloy of silicon and aluminum, with thin steel liners cast in the block. The bore is 62 mm. and the stroke 140 mm. (2.44 by 5.51 in.), the length of stroke thus being greater than twice the bore. It is claimed that at 2,400 r.p.m. the engine develops 50 hp.

An interesting feature of the engine is the patented piston, which is also of silumin. As may be seen from the sectional view of the engine, the combustion space is not surrounded by water-cooled walls, but is mainly in the hemispherical cavity of the piston head. At the moment of highest temperature, and therefore of maximum heat loss, the combustible gases are not in direct contact with water-cooled walls, and it is claimed that this results in a material increase in fuel economy. Overheating is prevented by the high heat conductivity of the silumin, the heat absorbed by the piston being conducted to the lower, cool part of the cylinder walls.

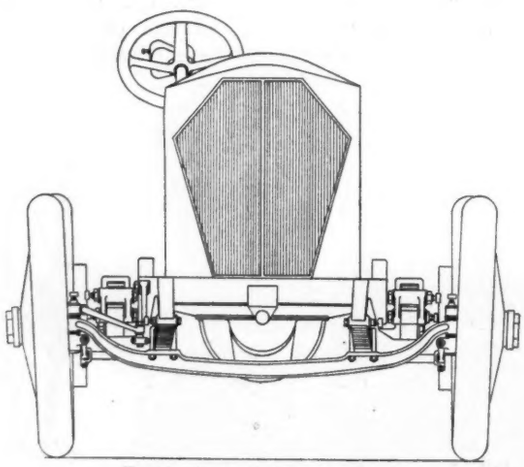
The upper end of the connecting rod is secured to the hollow piston pin, which has bronze bearings in the piston bosses. Lubrication of these bearings is effected



Powerplant used in Szawe car



Plan and side elevation of the new German Szawe chassis



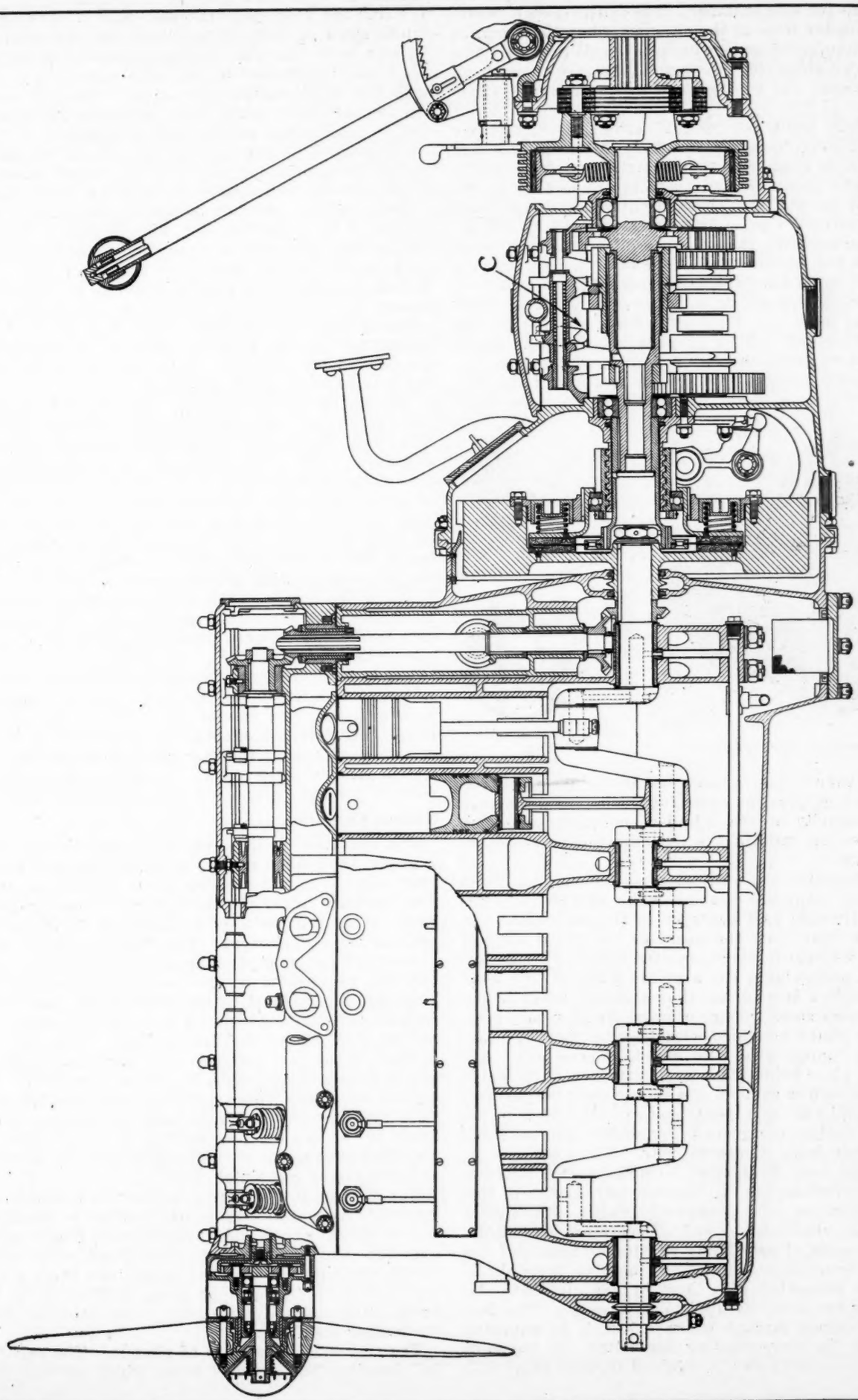
Front view of Szawe chassis

through inclined holes from an oil groove on the piston immediately below the lowest piston ring groove. The crankshaft is supported in four babbit bearings.

The valves are inclined toward each other at an angle of 60 deg. in the detachable cylinder head, and are operated by means of rocker levers from a common camshaft, which is driven from the crankshaft through a vertical shaft and bevel gears at the rear end of the engine. The camshaft drive is completely enclosed and arranged in such a manner that the timing is not disturbed when the cylinder head is taken off. The inclined position of the valves, together with the concave piston head, results in a substantially spherical combustion space, which makes for high thermal efficiency. The relatively long piston stroke tends further to cut down the area of wall surface to which the hot gases are exposed during the early part of the power stroke, and thus to increase the thermal efficiency. Notwithstanding the long stroke, the engine is comparatively low, and no annoying vibration is experienced.

All parts of the lubricating system, including the piping, are arranged in the lower part of the crankcase. Lubrication is by what is known as the dry crankcase system, that is, there is no supply of oil in the crankcase. Similar systems are used on some aircraft engines. A four-part oil pump is fitted, to insure uniform supply of oil to all wearing parts without over lubrication of any one part. The oil pump is located in a depression in the bottom half of the crankcase and is driven through a worm gear. On the pump shaft there are three eccentrics, two of which operate a differential or stepped pistons, while the middle eccentric operates the piston valve for the pump. The main pump piston delivers oil under high pressure to all of the main bearings of the crankshaft. From the rear bearing the oil ascends through a cast-in copper tube to the cylinder head, flows through the hollow camshaft to the camshaft bearings and cams, and on its return to the oil pump inlet passes through the bearings of the vertical driving shaft. The crankpin bearings are lubricated through the hollow crankshaft.

If, while driving downhill for extended periods, a considerable amount of oil collects in the forward part of the crankcase, a second pump piston draws this oil back to the oil well in which the pump is located. A third, smaller pump piston draws oil from an oil tank located above the oil pump and delivers it to the engine system

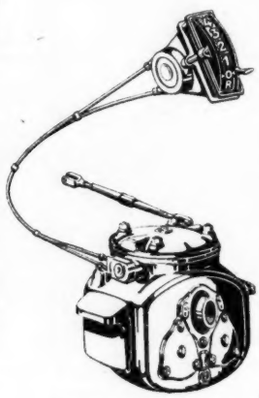


Sectional view of the powerplant used in the new Szawe chassis. Note unusual construction employed to disengage clutch by use of coarse threaded rotating sleeve

to make up for oil consumed. The fourth piston serves to maintain the level in the oil sump where the pump is located, pumping all excess back to the oil tank. By this ingenious arrangement the engine gets only as much oil as is necessary for good service and over-oiling is prevented.

Continuous webs are formed between the crankcase arms, extending from the crankcase to the frame side members, thus rendering a sheet metal underpan unnecessary. The generator and magneto are located on the left side of the engine. These are driven by bevel gears from the vertical shaft. The water pump is located on the right side of the engine and is also driven by bevel gears from the vertical shaft. The fan is driven at twice crankshaft speed from the front end of the camshaft by an enclosed planetary drive. The rotary speed (4800 r.p.m.) and large fan diameter called for a special design. A two-bladed wood propeller of the same shape as an airplane propeller, with a paraboloidal hub to prevent air eddies, is used. The high position of the propeller results in a better utilization of the free space above the engine. In consequence of the good fan efficiency, the high pressure centrifugal pump, and the good heat conductivity of the cylinder and piston material, the compression ratio of the engine could be made unusually high.

Semi-automatic Szawe gearset



Bowden wire selector device

The carbureter is a vertical type Zenith. Air flows through the crankcase bearing walls around all bearings, and through cast passages to the carbureter. In abstracting heat from the bearings the air is slightly preheated, while at the same time the bearings are cooled.

The dry plate clutch has a driven plate of thin steel sheet of such a small mass that a clutch brake is not necessary. Six small springs produce the necessary pressure. The plates are lined with Ferodo-asbestos, interlaced with copper wire. No clutch release levers are used, their place being taken by a large screw, by which means back lash is avoided and smooth starting insured.

The gearset has four speeds and reverse, and is of entirely new design, the gears being shifted automatically and the gear lever dispensed with. The design is by Count Soden and the gearset is built by the Zahnradfabrik Friedrichshafen. A diagrammatic sketch of this interesting transmission is shown herewith. It has three shafts (main shaft above) and all gears are continually in mesh, change of gear being effected by means of dog clutches. Gears 1, 2, 3 and 4 are loose on their shafts but can be connected with them by dog clutches. All other gears are firmly secured to their shafts. The first speed is obtained through gears 5, 1, 9, 8, by engaging gear 1 with the corresponding dog clutch. In the same manner, the second speed is obtained through gears 6, 3, 9, 8 and the third gear through gears 7, 4, 10, 8. The fourth speed or direct drive is obtained by engaging pins 11 with holes 12. The reverse is through gears 5, 1, 2, 10, 8 and is obtained by an axial movement of gear 2 with the corresponding dog clutch. Gears 1 and 2 of the two secondary shafts mesh with each other, but gear 5 of the main shaft meshes only with gear 1. The number of gears is 10, the same as in the usual 4-speed gearset, but the secondary gears are distributed between two shafts and the transmission therefore is very short.

Every sliding gear can be shifted individually and is connected by a shifter fork with a shifter bar. The shifter bars are pressed by springs in the direction of engagement, but are ordinarily prevented from moving in that direction by a rotatable shifter cylinder resting against pins of the shifter bar. The cylinder has on its circumference axially offset holes into which only one shifter bar pin can enter at one time, according to the position of the cylinder. When the bar is in position the gear belonging to it is locked.

The shifter cylinder has on one end two projecting pins which are connected through a small worm and bevel gear mechanism and Bowden wires to the pointer and lever of the gear selector on the steering wheel, so that if the selector lever is turned, the shifter cylinder is turned also. The shifter cylinder can be turned only when none of the shifter bar pins are in the locking hole and when it is freed from the spring pressure, resting on the shifter bars. This is effected by connecting the clutch pedal with the camshaft C so that by pressing down on the clutch pedal this camshaft is rotated and all shifter bars are withdrawn at once. The rotation of camshaft C begins only when the clutch pedal is completely depressed.

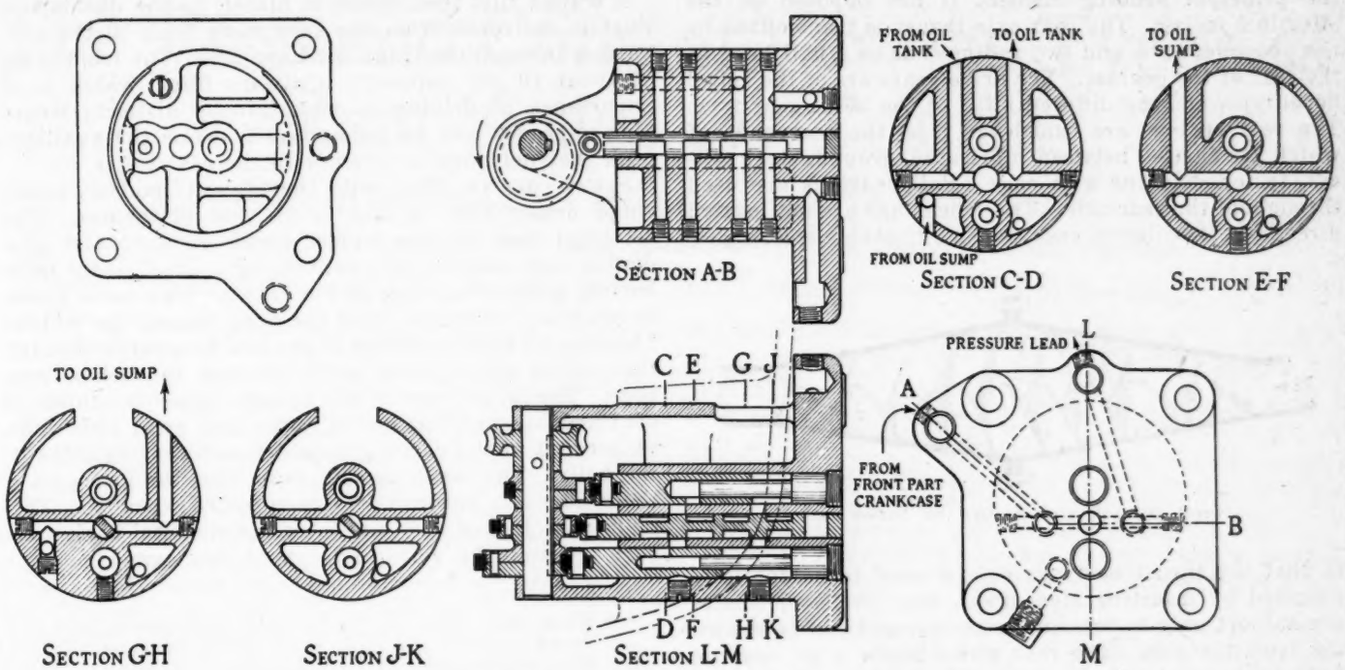
The lever of the gear selector is not rigidly connected with the shifter cylinder, but first operates a spring device, which in turn rotates the shifter cylinder if it is free. Therefore, the effect of the gear selector is preparatory. A pointer on the gear selector informs the driver, which gear is momentarily engaged. Of course, this pointer is rigidly connected with the shifter cylinder.

Gearset Operation

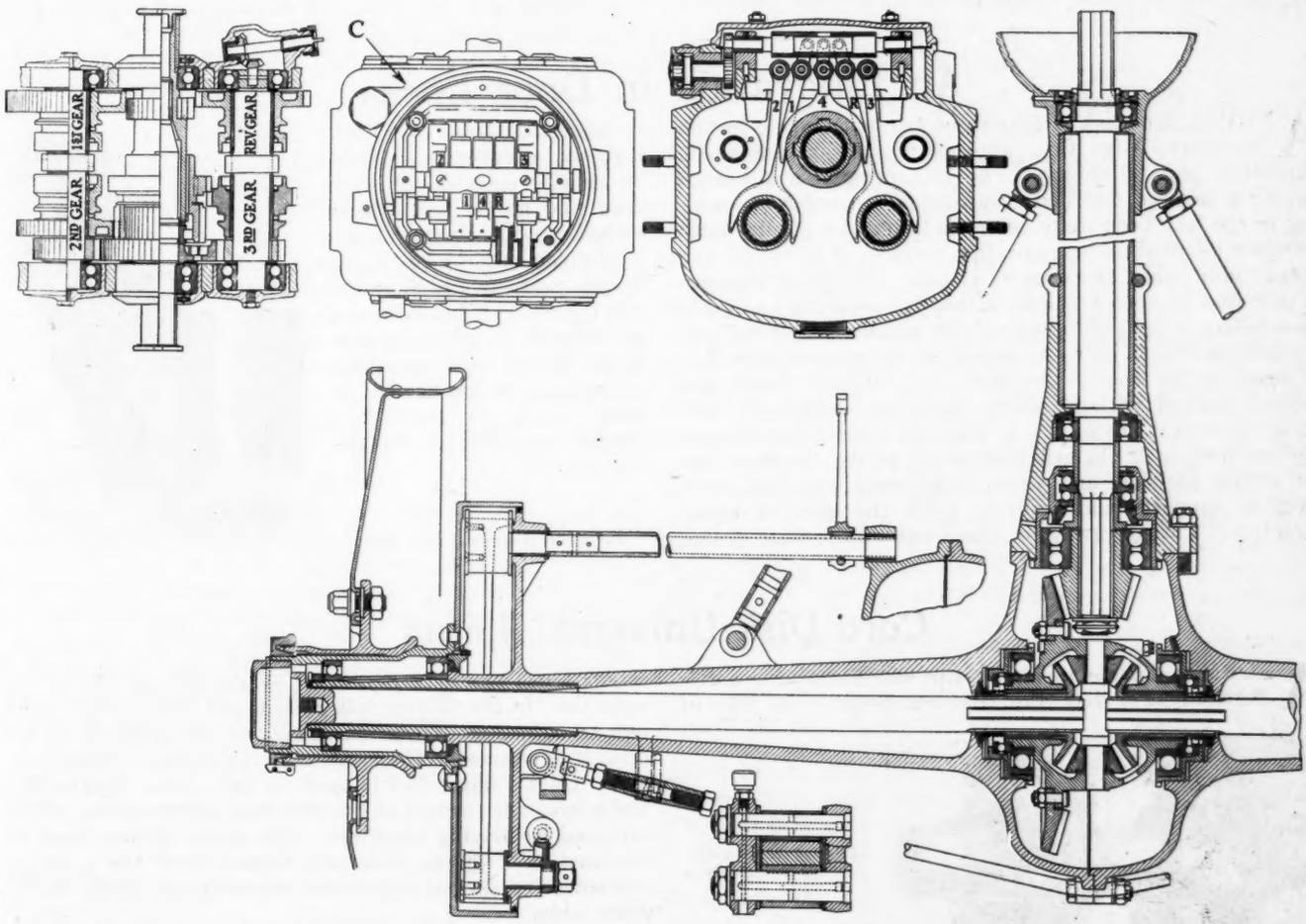
The operation of this gearset is very simple. If, for example, the second gear is engaged, the pointer of the gear selector on the steering wheel stands opposite the 2 on the dial. When the third gear is to be engaged, the lever of the gear selector is turned to 3, the pointer's position being unchanged. The change to the third gear is accomplished by depressing and reengaging the clutch, and can be effected at the most favorable moment, a long time after adjusting the lever of the gear selector, without taking the hands off the steering wheel. The pointer only shows the gear actually engaged. After having set the gear selector for a particular speed it is not necessary, for example, to engage that speed. When driving on second speed with the gear selector set for third speed, it is possible to turn the selector lever directly to the idle running position or to any other gear and then engage the corresponding gear by depressing and reengaging the clutch.

The starting motor is arranged on the left side of the gearset, driving through a spur pinion to the toothed rim of the flywheel. The transmission brake is pedal operated, and has internal shoes lined with asbestos fabric. On the outside of the brake drum there are cooling ribs, and a ratchet type sprag is fitted to the brake drum. Only one universal joint is provided, and that of the leather disk type.

The rear axle housing is of silumin. The rear wheel ball bearings run on steel tubes which are cast in the

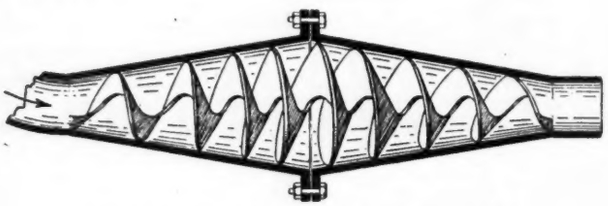


Sectional views of oil pump used on Szawe engine



Above, sectional views of gearset and, below, the rear axle with housing of silumin

axle housing and form one piece with it. These tubes extend to a point beneath the rear spring seats, so that the principal bending moment is not imposed on the silumin housing. The rear axle thrust is transmitted by the propeller tube and two radius rods to a ball head at the rear of the gearset. The drive gears are of the spiral bevel type, and the differential is of the bevel gear type. The rear springs are cantilever type, the rear ends of which are carried between lubricated, ground, steel rollers, fastened to the axle case. Ball bearings are used throughout the rear axle. These bearings are not located directly in the silumin case, but in adjustable steel cages,



Novel type of muffler used on Szawe car

so that the thrust bearings do not need to be specially adjusted by inserting steel disks, etc. The axle shafts are subject only to torsional stresses, and can be drawn out from the side. The rear wheel brake is an internal type with toggle mechanism. The steering gear is a screw and nut device of rather conventional design. The front wheels can be turned through the large angle of 40 deg. All joints are lubricated by grease cups, the front wheel hubs run on ball bearings and the steel disk wheels are detachable.

A Pallas fuel feed device is placed on the dashboard. Fuel is delivered from the rear main tank to the carbureter through the front auxiliary tank. The front tank, of about 10 gal. capacity, is always filled, which is of importance in driving in mountainous districts where long upgrades may be encountered. From the auxiliary tank the fuel flows by gravity to the carbureter.

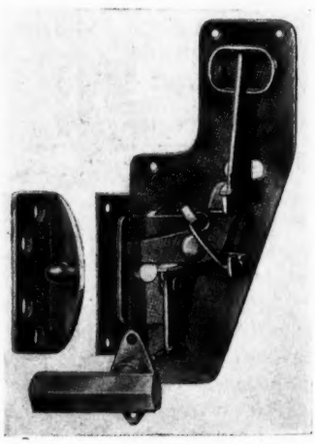
Szawe cars are fitted with the "Johest" muffler, a patented design that is said to be very efficacious. The sectional view of this muffler shows it to consist of a double cone shaped case, containing a sheet metal helix leaving a direct opening at the center. This helix varies in pitch and diameter from the ends toward the middle. The exhaust gases entering at one end flow partly through the central opening and partly through the helical passage. The larger part of the exhaust gases is subject to continuous expansion in the radial and axial directions, on account of the varying diameter and varying pitch of the helix. The result is said to be that the gases leave the muffler at a uniform pressure greatly expanded. This muffler is claimed not to give any detrimental back pressure to damp the noise and cannot be clogged.

Following data relating to the Szawe chassis is of interest:

Wheel base	3,475 millimetres (137 in.)
Tread	1,400 millimetres (55 in.)
Tires (front and rear)	880 x 120 millimetres (37 x 5)
Turning diameter	12 metres (40 ft.)
Seating capacity	6 persons incl. driver
Weight of chassis (without fuel)	850 kilograms (1,870 lbs.)
Speed	100 kilometres 1 hr (62.5 m.p.h.)

An Innovation in Door Locks

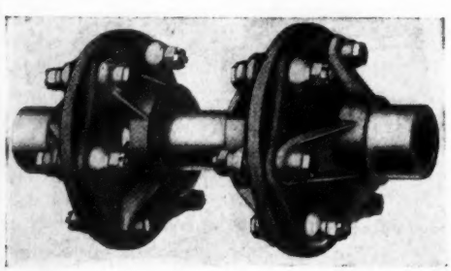
A NOVEL door lock is illustrated herewith, made by the Hooppaw Mfg. Co., who claim for it simplicity, durability and reliability. The lock comprises a keeper having a tapered, notched stud adapted to enter an opening in the lock body-plate. On the latter is a pivotal latch member adapted to engage the notched portion of the keeper stud when the door is closed. The latch member is operated to open the door either by pressing an inside push-botton or by pulling an outside handle, requiring only a slight effort and only one motion in the natural direction of opening the door. The door is positively closed and securely locked without undue force or slamming. Another important advantage is that the keeper stud, entering the opening in the lock body-plate, guides the door into the closed position, and when interlocked with the latch member supports and securely holds the door in every direction. Cutting away or mortising of the door frame is minimized, and the lock body-plate serves as a gusset or reinforcement for the door and at the same time makes it unnecessary to use a supplemental block or frame member for supporting the lock. The locks are made in both right and left-hand models and are furnished with either the inside push-button or outside handle, or both, as may be desired.



Detail of Hooppaw door lock

Cord Disk Universal Joints

A FORM of flexible universal joint which embodies a different type of disk from that which has so far been in common use has been developed by the Climax Motor Devices Co. In the Climax disk raised cord links extend from bolt to bolt, thus adding materially to the strength of the disk, it is claimed. The cords take the stress in direct tension. Only a single disk is used for each joint. Hemispherical bosses are formed at the bolt hole intersections, which are used as driving members. The metal spiders used in conjunction with the disks are formed to fit the disks on one side, and special cup-shaped washers are placed on the other side.



Climax cord disk universal joints

The manufacturer furnishes complete propeller shaft sets as well as double universal joint sets for insertion between the clutch and transmission.

The Pros and Cons of Various Types of Rear Axles for Trucks

A discussion of the advantages and disadvantages of the several types of construction in common use today, followed by an analysis of the stresses in axle shafts and the bearing loads which result under certain limiting conditions of torque and of forward and sidewise skidding of the truck.

By Ethelbert Favary*

THERE are five general types of final drive in use: (*a*) the chain and sprocket; (*b*) the bevel gear drive, with either straight or spiral gears, as mostly used on passenger cars; (*c*) the worm gear drive, which is now the most common type used on trucks; (*d*) the double reduction rear axle, in which two reductions are made between the propeller shaft and the rear axle; and (*e*) the internal gear drive, in which the first reduction is accomplished by bevel gears in the center of the axle, and the second by internal gears in drums or rings attached to the wheels.

Since bevel gears are not, as a rule, practicable for reductions in excess of about 6 to 1, their use on trucks, except on the smaller models, is ordinarily out of the question, for here the final reductions vary from about 6½ to about 14, depending on the capacity of the motor truck and the truck speed.

The chain drive on trucks is used on about 4 per cent of the models manufactured. The chief objection to the use of chains is their exposure to dirt and grit, which in time causes excessive wear and noise. A number of attempts have been made to enclose the chains by covers of some kind, but they gave more or less trouble and were not entirely successful, for provision must be made in the cover for chain adjustment and for the relative lateral as well as the vertical movement of the sprocket centers on account of sidesway and spring flexure. Hence, to-day, most of the chain drives run with the chains exposed and by the employment of hardened chain rollers, pins, bushings and links the wear and the noise are minimized.

Advantages of Chain Drive

Lack of lubrication is by far the most common reason for noisy chains. It is claimed that applying lubricant with a brush to the chains each day, which takes only a few minutes, results in greatly decreased noise and wear, and that with proper care and treatment chains will run from 40,000 to 50,000 miles. This figure is considered far too high by users of chain driven trucks. The following are the principal advantages claimed for the chain drive over the other forms of final drive:

(1) Simplest in construction.
(2) Will stand as much or more abuse than any other type.
(3) Average total efficiency, including the losses in the jackshaft, is as high or higher than that of any other form of drive.
(4) Increased losses due to worn chain and sprockets are very slight.
(5) Easiest form of final drive to repair, as repairs can usually be made on the road with spare links.
(6) Bevel and differential gears are carried on the sprung portion of the vehicle and are thus immune from road shocks.
(7) A substantial load carrying member can be employed, which in the event that it is damaged through accident is not likely to result in damage to the drive shaft and the gears.
(8) The differential gears and the drive shaft can be made lighter than in most of the other types as the maximum torque is produced only at the rear wheels.
(9) The universal joints are arranged to run in line between the transmission and the engine, since both are attached rigidly to the chassis.
(10) Offers the lowest unsprung weight, thus increasing the riding comfort.

Chain Drive on Heavy Trucks

Some firms use the chain drive exclusively for their heavier models but give the purchaser the option of a chain drive or a double reduction drive in the smaller sizes. The former offers a greater road clearance than the live-axle type of drive and a much greater range of gear-ratio changes than any other type. In the Mack truck, for instance, gear ratios can be made from 6½ to 1 to 14 to 1, without altering anything but the sprockets and perhaps adding or taking out a link or two of the chain.

In addition to greater wear and noise, chains will require more frequent repairing and renewing than the gears of the worm or bevel drives. When sprockets are worn until they are hooked, or until the true form has been destroyed and the teeth are slightly hooked at the ends of the driving side, they will cling to the chain as it leaves the sprocket and are then pulled away violently. It is claimed that this fault can be remedied by some forms of sprocket design. The chain drive is superior to the worm drive under heavy load and torque and only slightly less efficient than the worm under high speeds and light loads.

In the internal gear driven axle, first a bevel reduction is provided between the propeller-shaft and the rear axle, as in most passenger cars, and to obtain a further reduction at the end of the live axle near the wheel or in the hub small spur gears mesh with internally cut gears attached to the wheel.

One of the advantages claimed for the internal gear driven axle is great strength, since it permits the use of a solid, one-piece load carrying member, usually a drop forging of I-section or a round axle made from bar stock. Sometimes the load carrying member is flattened and shaped in the center to encompass the differential housing, while in some designs the live axle is within the load carrying member. Other advantages are (*a*) this axle can be made lighter than the worm gear type, since the

*Condensed from a paper presented at the March meeting of the Metropolitan Section, Society of Automotive Engineers.

jackshaft and the differential run at a lower torque than in the worm drive axle, the great speed reduction being made at the wheel, while the reduction at the bevel gears in the center of the axle is usually less than 2 to 1; (*b*) the internal spur gears and pinions are mounted on fixed centers and require no adjustment; and (*c*) the cost is low, while the efficiency is high and fairly constant at all loads.

One of the serious problems with most of the internal gear axles is the proper lubrication of all the parts of the drive, although it is claimed by its sponsors that this drive can run with very little lubrication. The large diameter at the ring gear gives plenty of opportunity for the grease to leak out around the edges of the gears and onto the brake. However, some types run in a constant bath of oil, and the joint is not close to the large diameter of the ring gear, but nearer the center. Another objection against the internal gear is that it is more difficult to provide the double internal brakes on the wheel. Even where the internal brake is used, considerable difficulty is experienced with the rise in temperature due to the application of the brakes, which may cause the lubricant to melt or burn. At present the tendency is to use internal rather than external brakes, as the latter form is exposed to dust and grit. The internal gear, as usually constructed, cannot be made in the semi floating construction, thereby eliminating the use of this design where the bearing pressures can be considerably reduced over those in the full floating type.

Disadvantages of Internal Gear Axle

Opponents of the internal gear axle further claim that it has several fundamental defects. In most of the internal gear types the load carrying member is the dead axle, but in some a central live member is inside the dead member, one or more extra idler gears being inserted between the jackshaft pinions and the internal gear rings in the wheel hub. In all internal gear axles the internal gear is carried by the wheel, or else in the wheel hub between bearings, and all wheels will develop a certain amount of play, since they have to take the road shocks. They will therefore not continue to run perfectly true, and the gears will not maintain their exact relation. If the gears run out of alignment with each other, instead of on a line contact, the contact will take place only on a point, under which condition gears cannot wear well or run silently nor transmit the power efficiently, for the slight play in the wheel will cause them to rock to and fro slightly.

In most internal gear axles the wheels are mounted on some form of dead axle while the jackshsaft, running parallel, is either in front of or behind it and encased in a separate housing, whose only function is to retain the live member. If axis of shaft and dead axle do not retain their parallelism, there is an additional tendency to throw the gears out of alignment. The torque reaction tends to revolve the jackshaft about the dead axle and is restrained from doing so only by the security of the end fastenings and by the rigidity of the dead axle against twisting. If the torque were always equal at both ends of the jackshaft, the twisting moments would be balanced, but since the traction of the two wheels is not absolutely equal, varying greatly at times, the torque stress on the axle is not equal on both ends. It is therefore claimed by opponents that this inequality of torque upsets the absolute parallelism of the two members, which will have a tendency to throw the pinions out of alignment with the internal gears.

In some constructions the load is carried on the dead axle, the jackshaft being perfectly free, not centrally supported; hence it is not deflected when the axle is deflected, and this will have a tendency to pull the gears out of line and cramp the pinion bearings. Sometimes means are provided to take care of the deflection by providing a universal-joint in the jackshaft, as in the rear axle of the De Dion-Bouton Co., and the Rochet-Schneider Co. of France. This, on the other hand, introduces a more complicated mechanism and a larger number of parts.

The type that has a separate dead axle weighs more for a given strength, since the larger outside dimensions of a hollow tube offer more strength with less weight; hence for the same factor of safety a solid axle is heavier than one of tubular construction. However, against the disadvantages enumerated is the fact that over 22 per cent of the models of trucks built in this country employ the internal gear drive and among its adherents are some of the well known companies.

The Worm Drive Axle

The worm and worm gear are usually assembled in a unit and then attached to the axle housing. In this axle the road shocks or stresses, except those coming through the driving axle, do not tend to disturb the alignment of the worm gear. Provisions should be made for preventing the oil in the center of the housing from running out through the hubs. Oil retainers are sometimes used on both the axle shafts and the wheel hubs for this purpose. A vent pipe in the rear axle housing will assist in overcoming oil leaks. Adherents of this axle claim that its average efficiency is very high and that a truck equipped with a high ratio will coast quite freely.

The great advantages claimed for the worm gear axle are the perfect mechanical enclosure of the final drive which is running in a bath of oil, and its practically noiseless operation. Even the wheel bearings are lubricated from the center housing, and when proper provisions are made there is no danger of the lubricant saturating the brakes. When the housing is filled with a suitable oil, the latter will last up to 5000 miles. Due to the perfect enclosure, dirt and grit are positively prevented from reaching the mechanism. Worm gear axles are frequently equipped with double internal brakes, a construction which affords excellent protection against dirt and grit. It is claimed that wheel brakes are more satisfactory than propeller-shaft brakes, for with the latter the stresses in the drive-shafts and the gears are considerably greater than when wheel brakes are employed, the torque arising from the locking of the wheels of loaded trucks being much higher than that of the engine.

Advantages of Worm Gear

Other advantages claimed for the worm gear are (*a*) its great simplicity, it having the fewest number of parts; (*b*) it is possible to obtain any desired reduction with two pieces, the worm and the worm wheel; (*c*) it is possible to obtain an almost straight drive from the engine to the rear axle; and (*d*) its durability is very great. It is better to have the weight in the center of the axle than at the axle ends, for when one wheel rises, or hits an obstruction and is thrust upward, the upward acceleration in the center of the axle will be only one-half of that at the wheel; hence the stresses induced will be smaller, and the action will be more like that of a smaller unsprung weight than if the weight were at the wheels.

Opponents of the worm gear claim that (*a*) it is a highly efficient power transmission gear only under certain conditions, for under a heavy torque a worm gear has a very low efficiency, while at high speed under light load, its efficiency is high; and (*b*) in coasting there is a certain amount of friction in the worm and the gear. Tests made by the International Motor Co. showed that trucks equipped with a worm drive did not coast as well as other types; hence, it is claimed, that even though the worm

may be more efficient than the chain under certain conditions, its average efficiency throughout the range of conditions encountered in service is lower.

The most vulnerable part of the worm drive is the bearing, which takes the enormous thrust exerted by the worm. In some axles ball bearings are provided at this point; others are equipped with taper roller bearings. Since the worm must be carried on the top to obtain sufficient road clearance, the worm bearings can be lubricated only by the oil carried up or thrown up as the worm wheel rotates. When this runs at a low speed, sufficient oil is not always carried to the top. To provide sufficient lubrication special means, like oil troughs, are sometimes fitted inside the worm wheel housing to catch the oil and lead it to the bearings. The worm drive is more expensive than other forms, but it is claimed that the maintenance cost is considerably less. When the pressure on the worm is not too high, the gears properly cut and the lubrication adequate, the film of oil is not squeezed out from between the surfaces, and there is very little friction. However, when the pressure is excessive and the oil is squeezed out, considerable friction exists and damage may result in a short time.

Another reason for rear thrust bearing failures is that the necessary play in the worm takes the form of a blow on the thrust bearing whenever the clutch is thrown in or speed changes are made. While taper roller bearings or ball bearings can withstand high pressure, they cannot withstand impact very well. Trouble with thrust bearings may also be caused by improper clearances, which, under excessive strain or deflection, cause an increase in the temperature with a consequent elongation of the worm. In the worm drive the torque induces pressure on comparatively small surfaces of the teeth, which rub one on the other, while with toothed gears or chains and sprockets there is more of a rolling contact than pure friction.

Some manufacturers claim that torque arms and radius rods impose additional stresses on the worm; hence they advocate the Hotchkiss drive. With this a cushioning effect is imparted to the drive as the springs permit the axle to rock back slightly in starting, thereby reducing the pressure on the worm teeth when the car is first started and the torque is high. It is also claimed that it permits the worm and the wheel to oscillate, thereby working more oil between the surfaces than is possible with a rigid drive. On the other hand, opponents of the Hotchkiss drive in connection with worm gears claim that they must put extra weight into springs when the latter are used to perform the functions of the torque and radius rods, and wherever satisfactory results are obtained with the Hotchkiss drive the springs must have a greater factor of safety. I believe that the Hotchkiss drive when properly designed gives satisfaction, even though the springs are relied upon to perform more severe functions. While many objections are brought forward against the worm drive, 68 per cent of all the truck models manufactured in the United States use this type of final drive.

The Double-Reduction Drive

In the double reduction rear axle two reductions take place between the propeller-shaft and the live axle. The first reduction is by a pair of bevel gears and the second by a pair of spur gears, or vice versa. Instead of straight bevel or spur gear teeth, helical teeth can be employed.

The advantages claimed for this type are (*a*) simplicity of construction, in that only comparatively small bevel and spur gears are employed, which lend themselves easily to quantity production; (*b*) all the gears are perfectly enclosed and protected from dust and grit, and run in a bath of oil; (*c*) its average efficiency is as high as that of any other drive and is substantially constant under all speeds and loads; and (*d*) the gears will always remain in alignment and are silent in running when well fitted.

The disadvantages cited against this drive are (*a*) an increased number of parts over the worm gear drive; (*b*) it is heavier than the internal gear and the chain drive, since the live axle has to carry the entire torque; and (*c*) it is more costly to manufacture.

Semi Floating Axles

By calculating the bearing loads and the shaft stresses of semi-floating and full-floating axles we will be in a position to determine their merits and demerits.

To find the bearing loads and the shaft stresses in semi-floating rear axles three distinct conditions must be considered. These are

(1) The maximum torque plus the normal radial load on the wheel.
(2) The wheel locked and skidding forward when the brakes are applied.
(3) The wheel skidding sidewise while the truck is running.

For example, a certain high grade truck axle has a

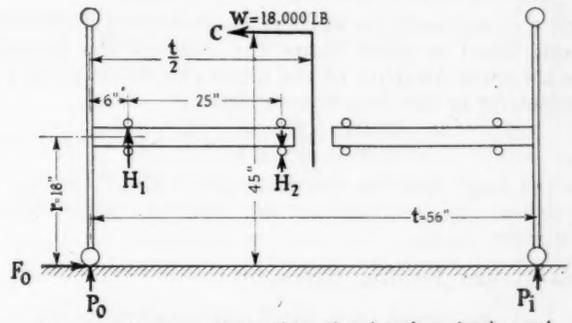


Fig. 1—Diagram illustrating the bearing loads and shaft stresses in a semi-floating axle

maximum total reduction of 49.61; the maximum horsepower is 50 at 1000 r.p.m. and the load on each rear wheel is 9000 lb. The torque in the rear axle shaft with a transmission efficiency of 85 per cent, and running in low gear is 132,850 lb-in. or one-half this amount, 66,425 lb-in., in each half of the rear axle shaft. On the other hand, if a transmission brake is employed or if the engine is speeded up and the clutch thrown in suddenly, causing the rear wheels to slip on the ground, the maximum force at the periphery of the wheel is $0.6 \times 9000 = 5400$ lb., 0.6 being the coefficient of friction between the tire and the road surface, and if the wheel diameter is 36 in., the torque in each half of the shaft is $18 \times 5400 = 97{,}200$ lb-in. However, we will not consider these conditions, for in our example no propeller-shaft brake is employed, and steel can stand a large momentary occasional overload without serious damage.

The shearing or torsional stresses in the shaft can be found from the well-known formula

$$S_s = T/J$$

where

J = the polar section modulus
S_s = the shearing stress in pounds per square inch
T = the torque

The diameter at the weakest point of the axle, which is close to the inner bearing, is 2.4375 in. The polar moment of inertia at this point is 0.1963 times the cube of the diameter. Substituting these values in the formula for the shearing stress, we have

$$S_s = 66{,}425 \div [0.1963 \times (2.4375)^3]$$
$$= 23{,}390 \text{ lb. per sq. in.}$$

At the outer bearing the shaft is 4 in. in diameter and the stress due to torsion at this point calculated from the formula is approximately 5280 lb. per sq. in.

We will now consider the bearing loads and shaft

stresses due to the bending moments. Under ordinary running conditions the radial load on each wheel is 9000 lb.; the distance between the bearing centers is 25 in., and between the outer bearing and the center of the wheel 6 in. approximately as shown in Fig. 1. If H_1 is the reaction or the radial load on the outer bearing, and H_2 that of the inner or the differential bearing, and if the radial load on the wheel is designated by P, then, taking moments about the outer bearing, we have

$6P = 25H_2$, hence $H_2 = (6 \times 9000) \div 25 = 2160$ lb.

Taking moments about the inner bearing,

$31P = 25H_1$, and $H_1 = (31 \times 9000) \div 25 = 11{,}160$ lb.

The bending moment in the shaft, 1 in. from the inner bearing, is 2160 in.-lb., increasing toward the outer bearing, where it is $2160 \times 25 = 54{,}000$ in.-lb.

The tensile and compressive stress S of a shaft is found from the formula

$$S = B/Z$$

where

B = the bending moment
S = the tensile and compressive stress of a shaft
Z = the section modulus

The section modulus, not the polar section modulus, of a round shaft is 0.098 times the cube of the diameter. Near the outer bearing of the shaft the diameter is 4 in. Substituting in the formula, we have

$$S = 54{,}000 \div [0.098 \times (4)^3] = 8600 \text{ lb. per sq. in.}$$

Near the inner bearing the diameter is 2.4375 in. and by substitution in the formula we find the stress equals 1523 lb. per sq. in.

Torsional and Bending Stresses

To find the stress in a shaft subjected to torsion and bending stresses, we may make use of an equivalent twisting moment T_e, which would create the same stress in the shaft as that due to the combined twisting moment T and the bending moment B and is equal to the square root of the sum of their squares. Near the inner bearing

$$T_e = \sqrt{[(2160)^2 + (66{,}425)^2]} = 66{,}500 \text{ in-lb. appr.}$$

almost the same as that found for the twisting moment only. At the outer bearing

$$T_e = \sqrt{[(54{,}000)^2 + (66{,}425)^2]} = 85{,}000 \text{ in-lb. appr.}$$

The stress in the shaft at the outer bearing is therefore

$$S_s = T_e \div J = 85{,}000 \div 12.56 = 6570 \text{ lb. per sq. in. approximately}$$

While at the inner bearing

$S_s = 66{,}500 \div 2.84 = 23{,}400$ lb. per sq. in. approximately,

showing that the stress in the shaft is much greater near the inner bearing.

The material used for this shaft is S.A.E. Steel No. 2340, which, if heat-treated to a Brinell hardness of 335, or a scleroscope hardness of 51, has a tensile-strength of 175,000 lb. per sq. in. and an elastic-limit of 150,000 lb. per sq. in. The shearing strength of steel is approximately 85 per cent of its tensile-strength or

$$175{,}000 \times 0.85 = 149{,}000 \text{ lb. per sq. in.,}$$

while the transverse elastic-limit or the elastic limit in shear is approximately 35 per cent of its ultimate shearing-strength, and this should be considered when finding the factor of safety. Therefore, the elastic-limit in shear equals

$$149{,}000 \times 0.35 = 52{,}150 \text{ lb. per sq. in. approximately.}$$

Very few data seem to be available as to the elastic-limit in shear of various steels, but at the weakest portion of the shaft the factor of safety is

$$52{,}150 \div 23{,}400 = 2.23 \text{ approximately}$$

under normal conditions, when running in low gear.

Next we will investigate the bearing loads and shaft stresses when the brakes are applied and the wheel is locked and sliding forward. In this case there is a horizontal force at the periphery of the wheel equal to the vertical or normal load of 9000 lb. resting on it multiplied by the coefficient of friction 0.6, as was mentioned before, or 5400 lb. The two forces, the vertical and the horizontal, act at right angles to each other. The resultant radial load R on the wheel due to these two forces is equal to the square root of the sum of their squares or 10,500 lb. If we call the reactions or bearing pressures in the outer and inner bearings H_1 and H_2 respectively, by taking moments about the outer bearing we have

$$6R = 25H_2,$$

from which

$$H_2 = 6R \div 25 = (6 \times 10{,}500) \div 25 = 2520 \text{ lb.}$$

Taking moments about the inner bearing, we have

$$31R = 25H_1;$$

hence

$$H_1 = (31 \times 10{,}500) \div 25 = 13{,}000 \text{ lb.}$$

The bending moment near the inner bearing is 2520 in-lb., and near the outer bearing it is

$$25 \times 2520 \text{ or } 6 \times 10{,}500 = 63{,}000 \text{ in-lb.}$$

Then, since $S = B/Z$, at the inner bearing

$$S = 2520 \div 1.418 = 1770 \text{ lb. per sq. in.}$$

and at the outer bearing

$$S = 63{,}000 \div 6.28 = 10{,}000 \text{ lb. per sq. in.}$$

approximately, the values for Z at the inner enr of the shaft being 1.418 and at the outer end 6.28 as found before. It is seen, therefore, that under these conditions, with the wheels locked and sliding forward, the stresses in the shaft are very low, especially in view of the fact that the shaft is subjected to bending stresses only. The material is in tension and compression, and its elastic-limit is 150,000 lb. per sq. in.

Stresses Due to Side Skids

We will now consider the bearing loads and shaft stresses resulting from skidding sidewise when turning a corner at a certain speed. Under these circumstances the centrifugal force F_c, which causes the rear of the truck to skid, will equal the coefficient of friction, 0.6, multiplied by the total weight, $6W$, carried by the two rear wheels. In this case, therefore, $F = 0.6 \times 18{,}000 = 10{,}800$ lb.

Assuming that the center of gravity of the entire load on the rear wheels is located 45 in. from the ground and calling this distance h; that the total pressure between the two rear tires and the ground is designated by P; that P_o is the pressure on the outer wheel and P_i that on the inner wheel when rounding a curve; that the tread, t, is 56 in. and that the radius of the wheel, r, is 18 in., then, by taking moments about the point where the inner wheel touches the ground, we have

$$P_o \times t = (W \times 1/2t) + (F_c \times h)$$

or

$$P_o = 1/2W + [(F_c \times h) \div t]$$

Substituting the assumed numerical values, we obtain

$$P_o = (18{,}000 \div 2) + [(10{,}800 \times 45) \div 56] = 17{,}700 \text{ lb.}$$

The load on the inner wheel will be 9000 — 8700 or 300 lb.

In addition to the radial load, there is a thrust load L_t on the two wheels arising from the tendency to skid; this thrust load is equal to the centrifugal force F_c and is disvided between the two rear wheels in proportion to their radial load. Hence, the thrust load on the outer rear wheel between the tire and the ground

$$L_o = 0.6 \times P_o = 0.6 \times 17{,}700 = 10{,}600 \text{ lb.}$$

Thus the total radial load on the outer wheel is 17,700 lb., and the side-thrust at the bottom of the wheel 10,600 lb. Taking moments about the inner bearing, we have

$$31P_o = 25H_1 + (r \times L_o)$$

or

$$H_1 = [31P_o - (r \times L_o)] \div 25$$

Substituting the corresponding numerical values for the various letters, we have

$$H_1 = [(31 \times 17{,}700) - (18 \times 10{,}600)] \div 25$$
$$= 14{,}300 \text{ lb.}$$

Taking moments about the outer bearing we have

$$6P_o = 25H_2 + (r \times L_o)$$
$$H_2 = [6P_o - (r \times L_o)] \div 25$$
$$= [(6 \times 17{,}700) - (18 \times 10{,}600)] \div 25$$
$$= -3384 \text{ lb.}$$

The result is a minus quantity, as the bearing will carry the load on the top, while under normal running it will carry it at the bottom. It should be remembered that the outer bearing also has to carry a thrust load of 10,600 lb.

Knowing the bearing pressures or the reactions we can easily find the bending moments and the stresses in the shaft, as in the last example. The bending moment B near the inner bearing is 3384 in-lb. and near the outer bearing

$$25 \times 3384 = 84{,}600 \text{ in-lb. approximately.}$$

In addition to the bending moment due to skidding, the twisting moment in the shaft due to the drive must be considered. Evidently the truck will have to be in the high gear to travel at the requisite speed to produce skidding; hence the torque will be much lower, but even if the truck were in the low gear, and the torque be 66,425 lb-in., the maximum stress in the shaft would be barely higher than under *straight forward* travel, when in the low gear. If the low gear torque is added, the equivalent twisting moment near the inner bearing is practically the same as that found before, 66,500 in-lb., and the shearing stress equals 23,400 lb. per sq. in. Near the outer bearing the twisting moment has a value of approximately 107,000 in-lb., and the stress is 8550 lb. per sq. in. When skidding sidewise the torque is considerably lower in practice, for the truck would not skid unless it traveled in one of the higher-speed gears, unless the road surface were muddy or slippery, and in such event the coefficient of friction is considerably lower; hence the bending moment would be lower. The maximum stress in shear is therefore near the inner bearing on straight forward travel in the low gear and amounts to 23,400 lb. per sq. in.

Full-Floating Axles

The stresses in the shaft of a full-floating axle are purely torsional or shearing stresses, and if the engine power and gear reduction are as in the last example, the maximum torque will be as found before, 66,425 lb-in. in each axle shaft. If the shaft dimensions are the same as in the previous example, the maximum unit-stress for torsion in the shaft metal would be as that found before, 23,390 lb. per sq. in. In a full-floating axle the shaft dimensions are, as a rule, uniform, not tapered as in the semi-floating type, since the live axle is relieved of all bending moments by the wheel bearings.

The maximum radial load on the wheels, when the brake is applied and the wheels slide forward, is the resultant radial load due to the combined horizontal and vertical forces and is the same as found before, 10,500 lb. If the distance between the bearings is 7 in., as shown in Fig. 2, the inner bearing H_2 is 2½ in. from the wheel center, and the outer bearing H_1 4½ in., then, by taking moments about the outer bearing, we find

$7H_2 = 4.5 \times 10{,}500$, hence $H_2 = (4.5 \times 10{,}500) \div 7 = 6750$ lbs.

and the load on the outer bearing

$$H_1 = (2.5 \times 10{,}500) \div 7 = 3750 \text{ lb.}$$

When the wheels skid sidewise, the bearing loads on the outer wheel are considerably higher. If the centrifugal force F_c that produces the skidding, and the radial load P_o are, as found before, 17,700 and 10,600 lb. respectively, then by the law of moments we obtain

$$7H_2 = 4.5P_o + 18F_c$$

hence

$$H_2 = [(4.5 \times 17{,}700) + (18 \times 10{,}600)] \div 7$$
$$= 38{,}700 \text{ lb.}$$

and

$$7H_1 + 18F_c = 2.5P_o$$

from which

$$H_1 = [(2.5 \times 17{,}700) - (18 \times 10{,}600)] \div 7$$
$$= -21{,}000 \text{ lb. approximately}$$

showing that on the outer bearing the load is reversed from its normal direction. In addition there is a thrust load of 10,600 lb. The results obtained are given in Table 1.

TABLE 1—COMPARISON OF STRESSES AND BEARING LOADS IN SEMI-FLOATING AND FULL-FLOATING AXLES

Type of Axle	Semi-Floating	Full-Floating
Maximum Stress, lb. per sq. in.		
Near wheel	8,550	23,390
Near differential	23,400	23,390
Maximum Bearing Load, lb.		
Outside of wheel	.....	—21,000
Inside of wheel	14,300	38,800
At the differential	—3,384	.....
Thrust load	10,600	10,600

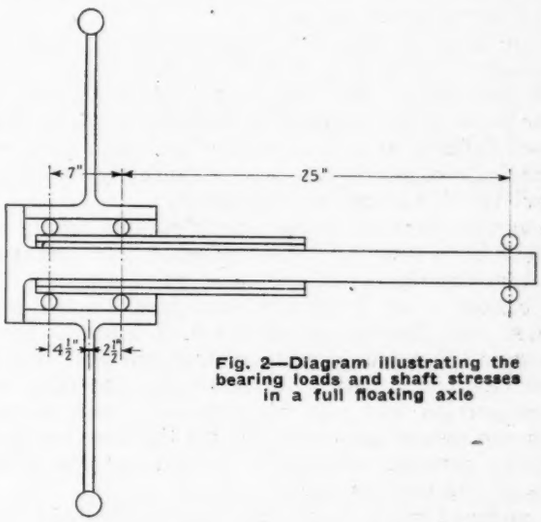


Fig. 2—Diagram illustrating the bearing loads and shaft stresses in a full floating axle

From Table I we can judge that the maximum shaft stresses are practically the same in both designs, but the shaft in the full-floating axle can be made lighter and at less cost since the stress is uniform in the entire shaft and the shaft is relieved of all but torsional stresses. Furthermore, in the semi-floating axle, the bending stresses are continually reversed; therefore a higher factor of safety should be used. The bearing loads in the full-floating axle are considerably higher, which will impose a much greater bending moment on the axle housing. Hence the bearings and the axle housing must be made heavier and thus this axle will be more expensive to manufacture than the semi-floating axle.

Standardization of Axle Parts

Following the presentation of the foregoing paper the chairman stated that the Council of the Society had asked the sections to take a more direct interest in the standards work of the Society, and that for this reason he had requested C. T. Myers of the Truck Division of the Standards Committee to discuss standardization possibilities in reference to rear axles for trucks. Myers thereupon made the following remarks giving his views on this subject:

Myers Suggests Axle Standardization

A casual glance through Favary's paper by an S. A. E. Standards Committeeman will cause him to contemplate with awe the enormous investment in axle spare parts it must entail to service the different makes of motor trucks already in operation. Further contemplation multiplies this by the amount of different manufacturing tool equipment necessary to produce them, and the terrific expense it must entail to keep the many little armies of salesmen each fighting their twenty sided battles over unimportant detail. Eighty million dollars is spent every year to sell trucks—a large part of it going to support fruitless detail arguments. The truck industry now generally recognizes that it must sell transportation and not details, and there seems to be a large opportunity to standardize on axle details. Everyone at interest will benefit by this, for all the well known types of rear axles are firmly established in the trade and give very good results in use. The user is not interested in axles if they carry his goods without disturbing his peace of mind. When accidents happen or wear takes place, however, he wants repairs made quickly and cheaply. This not only saves him money but keeps him in the frame of mind to spend it in buying another truck.

Having in mind that any suggestions I may make will be promptly corrected or amplified, I will put before you certain features of the various axle designs which seem to offer more or less attractive fields in which to pursue the well-defined and enormously profitable policy of standardization, which has been steadfastly fostered by the Society of Automotive Engineers.

The various types perform exactly similar functions in a variety of ways. (a) They support the springs on which rest the weight of body and pay load. (b) They carry brakes. (c) They are supported by the wheel bearings. (d) They carry parts which transmit the engine torque. For equal loads, stresses and similar points of attachment it is natural to think that the same bearings, proportion and size of parts, etc., will serve as well on one axle as another. In this light we can investigate the present subject by comparing the similar aspects of the various axles.

The range of truck sizes to-day may be divided roughly into 7 categories as indicated by their pay load capacities, viz., ¾-ton, 1-ton, 1½-ton, 2½-ton, 3½-ton, 5-ton and 6½-ton.

1—For each category standard spring center-lines and spring widths can be established, giving a reasonable variation for the time being by using spring pads that are wider than necessary. The spring centers will depend upon frame widths, a subject which is now being attacked with every reason to expect success. These established, the spring clips and nuts will readily fall in line. Even the spring pad drilling and spring seat height offer possibilities of being reconciled between chain drive and internal gear axles, and also among single reduction, double reduction and worm drive axles.

2—Standard brake drum diameters, widths and metal thicknesses are now being discussed in the S. A. E. Standards Committee and tentative dimensions have been suggested. Once these are determined the door is open to the crying need for standardizing the dimensions of brake linings, rivets, hinge pins, cams or toggles, diameters of camshafts and bushings, fits for camshaft levers, clearances and movements, release springs and all the unessential details that are so annoying when replacements are needed at an inopportune time or in an out-of-the-way place. There will be double paths to follow here by those who differ as to having more than one brake inside the drum, and possibly by the adherents of an external brake.

3—Once the brake drum width is selected the wheel spoke is located. The wood wheel can readily fall in line here and the steel wheel also. Our tire sizes are standard and also their fits on the wheels. Standard practice with reference to front wheel hubs has already been adopted by the S. A. E. The rear hubs should also yield to the same analysis and attack, although the solution will not be so simple. The hub details depend upon the type, size and location of the bearings used.

4—The wheel bearings cause a considerable diversification. Either ball or roller bearings can be employed in each of the five types of axles most used. But of these five types single reduction, double reduction and worm-drive can be grouped in both the fixed hub or full floating designs; while chain drive and internal gear drive can also be grouped. Thus, for each size truck axle 16 variations in bearing sizes, types, fits and spacing can be reduced to 6. Possibly a thorough study of the situation would still further reduce these as was found possible in the front hub bearing standardization, where over 200 hub variations were boiled down to 10, which are served by only 14 bearings.

5—Hubs, flanges, hub caps and wheel fits can be correspondingly standardized once the bearings are fixed.

6—The fits at the outer ends of spindles and drive shafts can be standardized in accordance with the classification given under 4; and if the wheel tracks are held close the spindles and drive shafts themselves offer possibilities.

7—4, 5 and 6 will react on the spring pads mentioned under 1, and help reconcile some discrepancies which may at first occur there.

8—Differentials can be standardized and the subject is now under consideration. A reasonable number of sizes, which will cover the range of torques to be transmitted, is all that is necessary. It should make little difference in what type of axle they are used. There would be a series for ball bearings and a series for roller bearings.

9—The above accomplished the fits for the inner ends of drive shafts would fall in line.

10—Bevel gearing, spur gearing and worm gearing all offer great opportunities for standardization. This should lead to a similar accomplishment for the bearings and bearing fits on worm spindles and bevel pinion spindles, but these can be standardized whether or not the gearing is standardized.

11—Adjusting devices for differential bearings and spindle bearings also offer a field.

12—The spindle fits for universal joint flanges have already been standardized.

13—Clevises and pins for brake lever connections have already been standardized. Possibly the levers themselves are susceptible to similar standardization.

Discussion of Favary Paper

O. M. Burkhardt of the Pierce-Arrow Motor Car Co. submitted a written discussion in which he explained his reasons for favoring the full floating type of axle for carrying loads up to 12,000 lb. He gave figures to show that the full floating construction is impracticable for greater weights than this.

W. F. Rockwell of the Wisconsin Parts Co. stated that he much favored the semi-floating design which he said weighs less in some instances than the full floating type. He stated that the cam-operated internal brake appears to be the only type which is not rendered inoperative at

times by snow and slush. He stated that he does not favor the propeller shaft brake because of its great sensitiveness, short life due to higher speed and the possibility of serious accident in case of shaft breakage which sometimes occurs before the truck operator realizes that the brake has become inoperative as a means for retarding the speed of the vehicle. He said that the use of bevel gear and double reduction truck axles is increasing and that in England, where the internal gear type was once used, it has been superseded by either double reduction or worm types. The double reduction type of construction involves lower stresses, he said, and less likelihood of costly renewals, due to injury. In common with most engineers, he favors light unsprung weight, but not so light as to interfere with proper alignment of the parts. All axle designs, he said, are compromise designs in which disadvantages are minimized as far as possible.

Effect of Unsprung Weight

A great deal of the discussion centered around the matter of unsprung weight. Favary stated that the greater the weight the greater will be the kinetic energy imparted to an axle where it is raised a given amount in passing over a bump in the road; consequently, the greater will be the shock imparted to the chassis with a given spring suspension. In this connection C. T. Myers stated that there is great uncertainty in regard to the effect of unsprung weight on tire wear It is generally assumed that tire wear increases with increase in unsprung weight, but Myers stated that he had yet to see any conclusive experimental evidence to substantiate this assumption. He mentioned certain tests in which it had been found that tire mileage on some worm-drive Pierce-Arrow trucks was as much as 70 per cent greater than that on similar trucks using chain drive, therefore presumably having much less unsprung weight on the rear axle.

R. E. Fielder of the Fifth Avenue Coach Co. stated that from 1910 to 1913 the tire cost on De Dion buses used by his company was 2½ cents per mile. These buses had extremely heavy rear axles in which the wheels alone weighed over 700 lb. The present cost per mile for tires on buses equipped with a worm-driven axle some 700 lb. lighter than formerly employed is about 0.85 cents. This result is not attributed so much to difference in unsprung weight as to improvements in the tires themselves, and the fact that steel wheels, which are said to hold their shape better than wooden wheels formerly employed, are used. Fielder considers that light, unsprung weight is an advantage, however, not only in respect to tire wear, but in respect to damage to the road surface, which is less with the lower unsprung weight. This fact should not be overlooked as it is certain to ultimately have, directly or indirectly, a considerable bearing upon the cost of bus operation

Advantages of Semi-Floating Axles

In one type of construction employed by the Fifth Avenue Coach Co. Fielder stated that it had been possible to effect a saving of 66 lb. in weight by the use of tubular as against solid axle shafts. He agreed with the author of the paper to the effect that it is better to have unsprung weight at the center than at the ends of the axle. He stated that the semi-floating type of axle possesses considerable advantage from a service standpoint in that it is not necessary to disturb the wheel bearings when the wheels are removed to change tires or repair brakes. With the full floating type of axle dirt is apt to get into the bearings when the wheel is removed and the bearings are not always properly adjusted when the wheel is replaced with the result that rapid wear of the bearings occurs.

Replying to Fielder's criticism of the wood wheel, Myers stated that careful comparative tests of wood and steel wheels had shown an advantage of 12 per cent in tire mileage in favor of the wood construction.

M. C. Horine of Mack Trucks, Inc., drew attention to the disadvantages of using two sets of brakes bearing on the same drum, since overheating caused by the use of one set of shoes adversely affects the efficacy of the second set. For this reason he favors the use of a propeller shaft brake which, he stated, is the only fully equalized type and is therefore least apt to cause skidding. Shaft brakes are serviceable, he said, if rigidly mounted on frame cross members. They are not in any case affected by spring action as are some wheel brakes.

Horine also drew attention to the advantages of a drop forged double reduction axle with banjo set at 45 deg., such as is used in some models of Mack trucks. He stated also that the chain drive has been much improved in recent years as have other types of drive. In answer to a question regarding chain life he stated that the chains used on Mack trucks give an average service of 18,000 to 21,000 miles.

C. W. Spicer of the Spicer Mfg. Co. stated that in his long experience in the manufacture of universal joints and propeller shafts, he had been unable to find that these parts are subject to any higher stresses when the propeller shaft brake is employed than when the brakes are on the rear wheels, but Favary took the view that the use of a transmission brake entails higher torque on the propeller shaft and universal joints and results also in greater axle stresses.

Propeller Shaft Breakage

A. F. Masury, chief engineer of Mack Trucks, Inc., stated that propeller shaft brakes are satisfactory only when they are well supported, and otherwise properly designed He stated further that his experience had shown that propeller shaft breakage is most apt to occur when the driver allows the engine to stop when the truck is coasting and then suddenly re-engages the clutch as a means of cranking the engine. He said also that the use of a full-floating axle with a live axle shaft made of very high grade steel provides a very flexible drive. Axle shafts used in late Mack trucks can, he said, be twisted through three full revolutions before breaking.

Masury stated that careful tests made by his engineering organization on trucks equipped respectively with chain drive, double reduction and worm gear axles had shown superior performance of the first two types, in coasting, climbing grades on second speed, average speed on hills, maximum torque and drawbar pull.

Masury cautioned against the possibility of the ill effects of too comprehensive standardization which, he said, would tend to prevent initiative and progress in improving design. He cited the Master Car Builders' standards as having prevented engineering development in the railway field, and said that the most successful concerns in the passenger car industry had paid least attention to standardization. C. T. Myers took exception to this view, stating that the most completely standardized passenger cars have proved to be the greatest commercial success. He also stated that M. C. B. standards had greatly simplified the problem of repair work wherever this work had to be done.

H. C. McBrair stated that it is possible to make spiral bevel axles with reductions of 9 or 10 to 1 and that with the multiple direct drive type of axle which he advocates it is possible to secure much higher fuel mileage than is usual with single bevel gear construction.

The Relation of Carburetion to Fuel Economy

Part II

Vaporization from a theoretical and practical standpoint is discussed by the author who concludes that proper operation of the entire carbureting system depends on complete and instantaneous combustion of the fuel.

By J. N. Golten

Figs. 10 to 14, taken from P. S. Tice's paper, "Flow in Intake Manifolds and Cylinders,"[5] give a visual indication of the complex flow lines in a simple two-branch manifold, and their variation with change in throttle opening.

Figs. 10 and 11 show the conditions existing in the manifold with the throttle slightly open. Notice that the fuel is not evenly distributed throughout the manifold cross-section, but flows in a comparatively concentrated stream. (Due to the small cross-section of the fuel stream the vaporization rate is greatly reduced. See section on Rate of Vaporization.) Of perhaps even greater interest is the fact that the flow lines in the two horizontal sections of the manifold are entirely different. This would affect the vaporizing action of a centrally located hotspot. A significant fact shown by Figs. 11 and 12 is the collection of fuel in the idle branch of the manifold when the right-hand cylinders are aspirating, and the absence of this collection when the left-hand cylinders are being charged. This phenomenon accounts for some of the inequalities of distribution.

[5] March, 1921, issue of the *Journal of the Society of Automotive Engineers.*

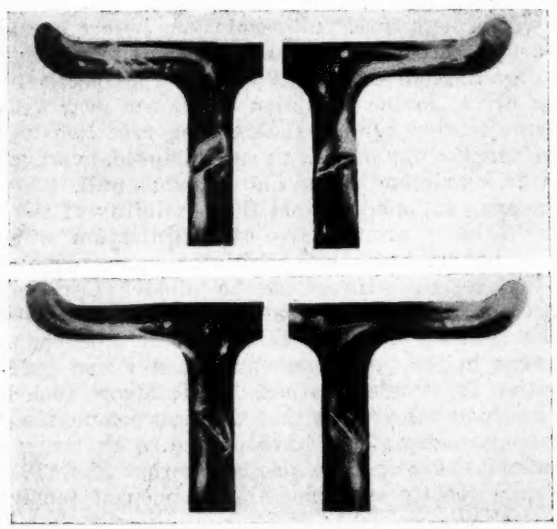


Fig. 10—(Above)—Note the concentrated fuel stream and unsymmetrical distribution in the manifold branches with the throttle slightly open. Fig. 11—(Below)—Opening the throttle still further does not change the nature of the distribution but results in an accumulation of liquid in one idle branch of the manifold

A further cause of unequal distribution among cylinders is the whirling set up in the bends forming the manifold outlets. Examination of the illustrations will show that in the two ends of the pipe the concentrations of liquid occupy somewhat different positions. When the whirling charge reaches the usual siamesed valve pockets it is almost certain that one cylinder of the pair will receive more of the concentrated stream than the other, a fact that is amply demonstrated by experience. In Fig. 13 is shown the open throttle condition which results in the nearest approach to equal distribution.

Charge Deflection by Throttle Valve

Fig. 14 is a section through the riser of the manifold in a plane at right angles to the outlets of the tee. The illustrations show the variation in the throttle deflecting action as the throttle is turned through 180 deg. Note the intense whirling action as the fuel is drawn into the horizontal section of the manifold. At open throttle the flow in the horizontal branch is unstable, whirling first in one direction and then in the other, which results in a symmetrical figure being recorded by the camera.

The illustrations just referred to are indicative of what happens in all manifolds no matter what their shape or size. Of course, it is true that conditions in some manifolds are much worse than in others; each manifold is a case by itself, but changing manifold shape, while it may improve matters, will never secure perfect distribution throughout the throttling range. Redesigning manifolds to secure better distribution is a long and ticklish task, nevertheless, it would well pay many manufacturers to undertake work of this sort.

Vaporization

Assuming that the metering and distributing problems of a carbureting system have been satisfactorily solved, there still remains the third important carburetion essential, vaporization. Unless all of the correctly metered and distributed fuel in the cylinder is available for combustion, the carbureting problem is still unsolved. Liquid fuel cannot burn; it is only when it is in a gaseous or vaporous state that the hydrocarbon fuel molecule can chemically combine with oxygen and liberate heat. Therefore, in order to secure maximum fuel utilization it is highly important that all the fuel be in such a physical state that its potential heat energy can be utilized.

Not only must the fuel be completely vaporized, but the vaporization must be complete at the time the spark passes in the cylinder. Only that portion of the fuel that is vaporized is effective in forming a combustible mix-

ture. Therefore, if a portion of the correctly metered fuel should remain liquid, the mixture would be so lean as to cause a performance loss. In order to supply this deficiency in vapor content, the operator would be forced to supply an excess of fuel, which entirely upsets the metering relations, causing an attendant loss of economy and other detrimental effects.

That portion of the cylinder heat which is available for vaporization is extremely limited; therefore most if not all of the vaporization must be done elsewhere. Before discussing the means of vaporizing fuels it may be well to state some of the fundamental conditions controlling vaporization.

Fig. 12—Throttle approximately half open. The accumulation of liquid in the idle right hand branch is very evident. Fig. 13—Throttle wide open. The fuel flow in the two branches is practically uniform

From the molecular standpoint, vaporization means the flying off of molecules against the forces of molecular attraction, these molecules losing kinetic energy (heat) and gaining potential energy as they leave the liquid. The more rapidly moving molecules will be the first to fly off, hence the average kinetic energy of the molecules remaining behind will be less than the initial average for the liquid, and the liquid will be **cooled** by evaporation. If the vapor is confined over the liquid, some vapor molecules will strike the surface and become liquid again, and as the number of vapor molecules per unit volume (i.e., the density of the vapor) increases, the number of molecules returning to the liquid per second will likewise increase, until finally the average number returning will equal the average number leaving. Under these conditions the vapor is in equilibrium with the liquid and evaporation ceases. The density, and hence the pressure, of the vapor which will be in equilibrium will depend on the temperature, that is, on the average molecular velocity. A vapor in equilibrium with the liquid is said to be **saturated**, and the equilibrium pressure is called the saturated vapor pressure (or vapor tension), which for a given substance depends upon the temperature. If the vapor is not allowed to accumulate over the liquid it will remain unsaturated, equilibrium will not be reached and the liquid will gradually disappear by evaporation. The larger the extent of the liquid surface the greater the rate of evaporization. If no external heat is applied to the liquid during the time this vaporization persists, its temperature will progressively decrease and the process of vaporization will become slower and slower. Similarly, if heat is supplied to the liquid at a rate faster than it is being made "latent" by the change in physical state, the process will be accelerated. The vaporization of a definite quantity of a given liquid requires a definite amount of heat, and the faster the heat is supplied the faster is the rate of vaporization.

Rate of Vaporization

Vaporization may be accelerated in three ways:

1—By an increase in the exposed liquid surface.
2—By the removal of the vapor as fast as it is formed.
3—By the addition of heat.

Of these means the last is by far the most effective.

As stated before, the ideal carbureting system would be one in which the fuel would be delivered to the cylinder in such a condition that its vaporization would be complete at the instant combustion commences. To attain this condition the fuel must be completely or largely vaporized before it enters the cylinder, and the remaining liquid portion, if any, must be in the best possible condition for rapidly absorbing the limited heat supplied by the cylinder, that is, in a fine state of subdivision so as to present the greatest heat absorbing surface.

In the carbureting system the means of accelerating vaporization are two, namely, extension of liquid surface and addition of heat. It is the problems attendant upon the proper application of these two means that has engaged the attention of the carbureter people the past few years.

Need for Heat

With our modern liquid fuels it requires a comparatively large amount of heat to get complete or nearly complete vaporization of the fuel in the short space of time during which it is traveling from the carbureter to the cylinders. Mere extension of the liquid surface by spraying from the carbureter nozzle will accomplish very little as far as vaporization is concerned, this being especially true with the conventional carbureter in which the throttle plate is placed in the carbureter outlet. No matter how fine the fuel spray may be when it leaves the carbureter nozzle, it is almost immediately recombined after it travels the very short distance between the nozzle and throttle plate, due to striking the latter. Whatever effective spraying is accomplished takes place from the edge of the throttle plate (see Fig. 14). This does not apply at open throttle, but when we take into consideration the fact that more than 90 per cent of the time a car is operating the throttle is more than three-quarters closed, it can be realized that those carbureter manufacturers who claim superior operating properties due to more effective spraying are suffering from a delusion.

Application of Heat

Realizing the need of heat to complete the necessary vaporization it now remains to be seen how this heat may be most economically supplied for the most effective application. Inasmuch as the exhaust gases with their large waste heat content can at all conditions of speed and load supply more than enough heat to completely vaporize all the fuel that is used, they obviously represent a very practical and economical source of the necessary heat. The great problem in connection with vaporization is the practical application of this heat.

About the first method that would suggest itself would be preheating the air before it reached the carbureter by passing it over a section of the hot exhaust pipe. This method would result in a loss of power due to the decreased density of the air. If the air were pre-heated sufficiently to vaporize all the fuel this loss in maximum power would become quite large. The magnitude that this loss may assume may be better realized when it is stated that even with intake air temperatures as high as 500 deg. Fahr. some of the fuel in a manifold still remains in the liquid state.[6] At this tempertaure the air

[6] See "Intake-Manifold Temperatures and Fuel Economy," by W. S. James, H. C. Dickinson and S. W. Sparrow, in the August, 1920, issue of the *S. A. E. Journal.*

density would be approximately one-half of that of air at 80 deg. Fahr. Assuming a constant volumetric efficiency, this temperature would result in a decrease of maximum power amounting to 50 per cent.

Some engineers, in an endeavor to vaporize the fuel without heating the air excessively, have exhaust jacketed portions of the intake manifold. This method has the advantage of transmitting some of the necessary heat by direct conduction to the fuel moving along the walls. However, even with this advantage the method results in high charge temperatures without completely vaporizing the fuel.

Hotspot Manifolds

A further modification in design was the introduction of the so-called hotspots. These are nothing more than

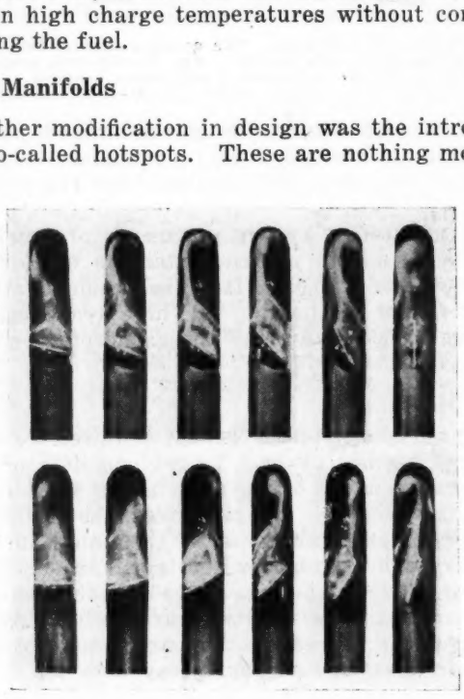


Fig. 14—Change in flow conditions in the manifold as the throttle is rotated through 180 deg. Note the swirling action as the fuel is drawn into the horizontal branch

allegedly highly heated sections in the intake manifold. They are of comparatively small area and are generally placed just above the intake riser on the horizontal portion of the manifold, on the assumption that due to centrifugal force, caused by the rapid change in direction, the fuel would be thrown out onto the hotspot and evaporated. Figs. 10 to 13 show what actually takes place at this point. This method of vaporization does not heat the air excessively and consequently causes no appreciable loss in power. However, neither does it give sufficient heat to vaporize more than a relatively small percentage of the fuel, so further modifications in design have been introduced. These consist of additional hotspots placed near the valve pockets or points where the fuel tends to collect, and small heated pockets used in conjunction with baffles, which deflect the liquid fuel into them.

These additional modifications, while they do improve engine performance and to some extent eliminate oil dilution and other evils attendant upon introducing liquid fuel into the cylinders are, nevertheless, only makeshifts at best, because from the viewpoint of maximum performance and economy they are fundamentally wrong.

Hotspots located at the valve pockets and in the manifold branches, even though they should vaporize all the fuel, which they do not, vaporize it only after it has been unequally distributed and thus fail to eliminate one of the chief sources of excessive fuel consumption. The proper time to vaporize all the fuel is before it is distributed. Then there will be no distribution problem.

Any method of carburetion that allows liquid fuel to wet the manifold walls is essentially wrong from the standpoint of maximum economy, no matter how perfectly the fuel may eventually be vaporized. Unless the entire manifold is dry at all loads and speeds, there will always be a loss in fuel economy, due to the fact that the carbureter will have to be set so that normally it will deliver more fuel than is necessary for good economical running. The reason for this may best be shown by describing the changes that take place inside a manifold due to a fluctuating load.

Let us assume the engine to be lightly loaded, a condition favorable to maximum vaporization, because the amount of fuel to be vaporized in unit time is small and the manifold pressure is low, resulting in a low boiling temperature for the fuel. The result is that relatively little liquid exists in the manifold, and its walls will be as nearly dry as they can ever be.

If the throttle is now opened somewhat, due to a demand for more power, the quantity of fuel to be evaporated in unit time is suddenly increased and the manifold pressure is also increased, resulting in a higher fuel boiling temperature. The amount of heat available for vaporizing the fuel is practically the same, for although the exhaust temperature also increases, its effect on the various heating devices lags so far behind that it is of no immediate assistance. Under these circumstances the equilibrium condition previously existing is disturbed, a lesser proportion of the fuel is evaporated, and liquid fuel quickly collects on the manifold walls. If this load condition continues long enough a new equilibrium condition may be attained at which the rate of fuel vaporization and distribution will be equal to the amount of fuel being metered by the carbureter. However, during the time the walls are being wetted, unless some provision has been made for feeding a large excess of fuel, the mixture will be so lean as to cause a large loss in power, or even total failure to ignite. Since the quantity of fuel necessary to wet the walls is much larger than can be supplied by any accelerating well, the only remedy is to set the carbureter to deliver an excess of fuel, so that normally the mixture will be richer than necessary for steady loading, resulting in an inevitable loss in fuel economy.

If now the load decreases, vaporization conditions improve and the fuel on the walls evaporates, making the effective mixture far richer than necessary.

Although these various vaporizing devices might function very well under a condition of constant load, and the carbureter could be set to operate economically, it must necessarily be set for the normal, more severe conditions, of widely fluctuating load, with the results just stated.

Vaporization, Distribution and Economy

The statement that the fuel must be completely vaporized before combustion commences may be further elaborated by adding that this vaporization must take place before the fuel has an opportunity to wet the manifold walls. Even though there were available a carbureter with this advantageous characteristic, it could not successfully be used with our present-day manifolding and vaporizing arrangements. Wet walls and unequal distribution of the manifold liquid make so many demands upon the metering unit, demands which must necessarily be complied with, that its successful operation depends on a large number of compromises, with a resulting large loss in economy. Therefore, the first and most important step that can be taken for increasing the fuel utilization of our modern engines is the redesign of the entire manifolding system so as to evaporate instantly and completely all of the fuel before it is

distributed into the several manifold branches. Obviously, this result should be accomplished without unduly raising the charge temperature.

The good results attained with such a system would not end with decreased fuel consumption. The total vaporization of the fuel would be a long step in the elimination of what are now thought to be the chief troubles of internal combustion engines. Dilution of oil by the liquid fuel, with consequent cylinder and bearing wear, would be entirely eliminated. With the leaner and dryer mixtures used, carbon formations would be greatly reduced. In addition, the engine performance would be materially improved, both as regards smoothness of running, due to more equal power impulses and accelerating ability. It has been proven that the accelerating abilities of an engine depend not upon the metered air-fuel mixture ratio, but upon the actual fuel available for power production at the instant the charge is ignited,[8] which is another way of saying that the fuel must be in a vaporous state. Taken as a whole, vaporization, properly accomplished, has everything in its favor and nothing to be said against it. It would be well if our engine and car designers would take notice of these facts.

Keeping in mind all that has previously been said, let us see in what particulars our present carbureting systems should be changed, so as to more nearly approximate an ideal carbureting structure.

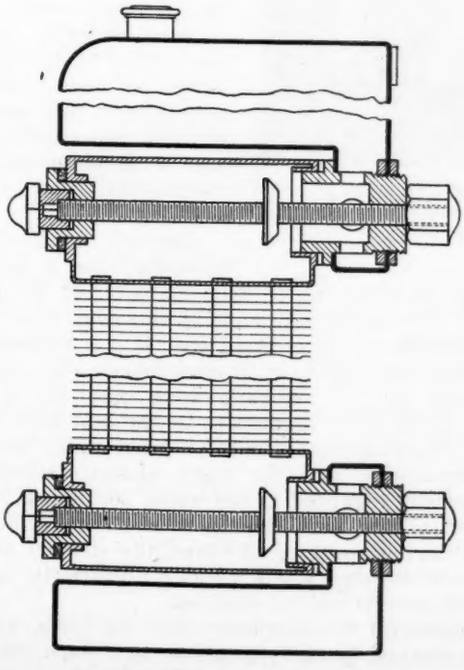
Since the proper operation of the entire carbureting system hinges on the complete and instantaneous vaporization of the fuel, the most important fundamental change will be in the means for vaporizing the fuel. This is the crux of the entire matter. There must never be any liquid fuel on the manifold walls. This point cannot be over-emphasized.

Only with the fuel completely vaporized are there no distribution problems, and then only does it become possible to use a carbureter that will meter the fuel to the greatest advantage. Such a carbureter should be designed so that variations in the mixture ratio will be solely dependent upon the change in manifold pressure, which is a direct function of the load carried by the engine. The mixture ratios should be those that would give the highest economy at all loads until nearly maximum manifold pressure is reached, when the ratio should change to give maximum power. There should be a minimum of adjustments on the carbureter so that once this setting is determined for any given engine it should be beyond the power of the operator or any misguided mechanic to alter it. Whatever adjustment is provided should be very weak and influence the metering relations only at idling.

Correction: An error occurred in the last paragraph of the first column p. 667 (Part I of Mr. Golten's article). The portion which was incorrect should read as follows: K is equal to the ratio of the density of the air passing through the throat to the density of the fuel (d_a/d_f) and is included so that the metering head (h), or force which causes the fuel to flow, can be expressed in terms of height of fuel column.

New Sectional Radiator Design

THE Avios radiator, herewith illustrated, is a new sectional type developed in France by M. L. Chardard, and which has been brought to this country by the Framerican Industrial Development Corp. The new principles involved have to do with the method of joining the sections to the top and bottom tanks and can be applied to radiators of any outside form and of any type of core element.



Cross section of Avios radiator

One advantage of the Avios design is that any section can be quickly put out of action, so that if a part of the radiator core becomes injured it does not incapacitate the entire radiator. A spare section or tube can be substituted for an injured one practically without loss of water, and, incidentally, the rate of flow through the core sections can be throttled and thus the rate of circulation be changed at will.

The vertical core elements are provided at both top and bottom with a header, and these headers are secured to the top and bottom tanks in a suitable manner. A nipple is soldered into the header at one side, and this nipple passes through holes in the opposite walls of a downward extension of the top tank and an upward extension of the bottom tank, both extensions being on the rear side of the tanks and of small depth in the fore and aft direction. On the outer, threaded end of this nipple there are two flat nuts between which the rear wall of the tank extension is clamped.

A threaded rod passing centrally through the header serves to clamp the core element to the tank. Each rod has a valve disk soldered to it. By turning the rod, by means of a nut serving as bolt head, the valve disk can be brought up against the end of the nipple so as to close its outlet. The valve disk has a conical seat, which is brought up against the sharp edge of the nipple, so that even if there should be scale on the valve the outlet of the nipple will be closed up tight, it is claimed. After the injured section has thus been shut off it may be removed and replaced by a spare section, whereupon the valves at top and bottom are opened again, which completes the repair. It is thus not necessary to drain the radiator to substitute the spare section for the injured one. If no spare section is carried the car, of course, can be operated with one radiator section missing until a spare can be procured.

Expediting Body Finish Operations by Use of Drying Equipment

A description of modern facilities for decreasing the time and space required to finish automobile bodies. Use of cleaned, heated and humidified air is said to give more uniform and satisfactory finish than does a greater number of coats with natural drying. Time schedules are given in detail.

By J. Edward Schipper

AUTOMOBILE manufacturers are becoming increasingly interested in methods for reducing the amount of time required for bodies in process. It has been realized for a long time that it is one of the fundamental requirements of quantity production that a piece of work move continuously from the time it starts to be fabricated until it is completed. It has been possible to do this in the chassis, but in the bodies, particularly in painting operations, long pauses between different operations are required because of the necessity for using siccative coats, which require time for the evaporation and oxidation process which must be gone through to achieve what is generally known as drying.

Considerable study has been given by a number of concerns to methods which will shorten the drying period, or in other ways reduce the length of time required for the body to have the painting and trimming operations completed. A very radical change in practice which has made possible to materially shorten this time is the discovery that it is possible to make as good if not a better paint job with a considerably less number of coats than was formerly thought essential. This multi-coat idea is one of the direct descendants of carriage builders' traditions. Ten years ago, thirty-five to forty coats were not exceptional for high-grade work. To-day thirteen well selected and properly applied and riage builders' tradtions. Ten years ago, thirty-five to

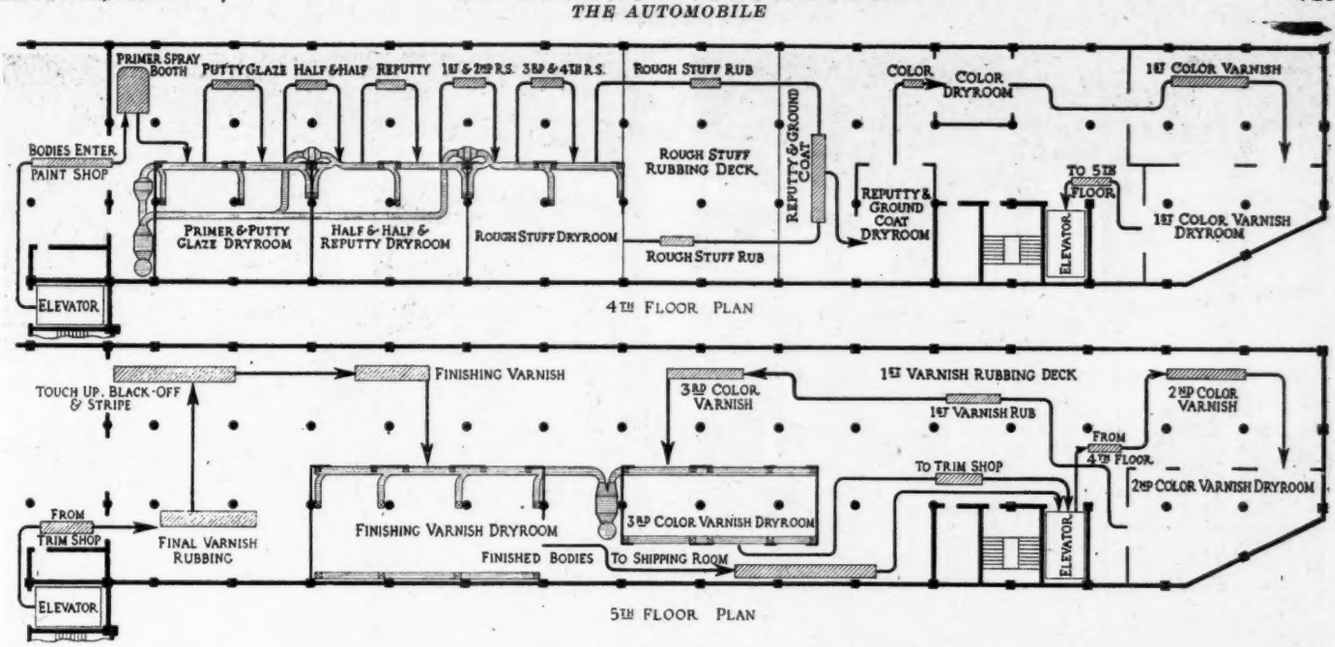
Ovens used at the Franklin plant for paint drying. Apparatus for cleaning, heating, humidifying and circulating the air, supplied by Drying Systems, Inc. is seen at the right

Another way in which the number of bodies and, consequently, the amount of money tied up in bodies in process can be reduced is in the use of methods for more rapidly drying the various coats. The importance of this increased speed in drying may be realized if a concern making 50 bodies to-day may be taken as an example. Assuming the average time for painting without artificial drying is 24 days and the average value of the body during this period is $300, the space necessary for painting and drying would then be that required for 1200 bodies in which would be tied up the sum of $360,000, the interest on which at 6 per cent for 24 days is $1,420. If this time can be cut in half by the introduction of a modern drying system, both the floor space and the interest on investment in bodies would be half in the saving, and interest alone would be nearly 60 cents per body. To this must be added the interest on capital invested in plants, which will, in the latter case, of course, include the drying, and from this must be deducted or added any increase or saving in operating cost.

That there is a considerable net saving is evidenced by the fact that drying systems are being extensively used and are being adopted in an increasing measure both by body and car manufacturers. This is not confined to manufacturers in any price class, but is to be found from the highest to the lowest. The principle, of course, finds its maximum economy in the case of the all-metal bodies where a thin but durable finish can be successfully baked on at high temperatures. Even with the metal body built over a wood frame, however, in which the paint coats cannot be baked at such a high temperature, it has been found possible to completely finish and trim, using a standard twelve coat schedule in 4½ working days.

One of the concerns responsible for a number of successful installations of this character is Drying Systems, Inc. The equipment made by this concern is designed to duplicate ideal drying conditions. It is a well-known fact that drying time varies with atmospheric condition. The spring and fall of the year have been known among carriage builders for decades to be the best time in which to paint a carriage which is to be dried under best atmospheric conditions, and the warm summer months have been generally regarded as the worst period. If it is possible to duplicate ideal drying conditions in the drying ovens or drying room at all times, the element of chance is largely eliminated and a greater uniformity as well as rapidity in results will be obtained.

It is essential to remember that the term, drying of siccative coating, is really a misnomer. Such coatings do not dry, but oxidize. What is called the drying action is



A suggested layout for a paint shop using a progressive system of painting and trimming

really a chemical reaction having two periods. During the first period the volatile solvents are evaporated and during the second there is the chemical reaction of oxidation of the oils. (These oils are transformed chemically into oxides which are solid as compared with the more or less liquid form of the coat when first applied.) It has been found that the presence of moisture in the air is necessary for the oxidation or so-called drying of the coat. Furthermore, there are different ideal atmospheric conditions for each kind of coating and for different colors, while for different colors it may be necessary to have different degrees of temperature and per cent of humidity in the air. Experimentation on these subjects is by no means complete, but a great deal has been learned about them and it is possible to apply the knowledge so gained in commercial work to the extent of being able to greatly accelerate the drying of the various coats.

Moisture Essential

Probably the most difficult point for the average layman and often even the experienced finishing foreman to grasp is that moisture in the air is essential to drying. The theory of the value of the moisture content is that the moisture acts as a catalytic agent and co-operates with the increased heat in performing the chemical reaction of oxidation. The drying equipment is designed to duplicate the ideal conditions of temperature and humidity for various kinds and colors of paints. The advantages claimed for the process outside of the shortening of the drying period and consequently the reduction of the number of cars in process are the consequent reduction in the amount of floor space required to finish a definite number of jobs per unit of time, and the ability to turn out a product with an unvarying color standard.

In the drying of automobile bodies it is essential that the primer, lead and rough stuff coatings receive the same careful treatment accorded to the varnishes, since the strength and durability of the final finish depends entirely on the proper drying of the under coatings. In other words, the job has to be engineered from the ground up. It is just as important that the under coatings be uniform and of proper elasticity as the under coatings, because the failure of a under coating invariably means the breaking down of the exterior finish.

In the best installations of a drying system, the under coat and color varnish operations are generally conducted in the dry rooms of a compartment type located in close proximity to the spray booth. The size and numbers of the dry rooms and ovens, of course, depend on the production requirements. In the case of touring car bodies where it is necessary to rush a large number of bodies through a small space, a material saving can be made in the dry room space by up-ending the bodies in the under coat and color varnish dry rooms. It is claimed that with a properly installed drying system this can be done in perfect safety in the under coat and color varnish dry room. On a production job the schedule for under coat and color varnish drying periods would approximate: Primer, 2 to 5 hr.; lead, 2 to 5 hr.; rough stuff, 2 to 3 hr.; flat color, 1 to 1½ hr.; color rubbing varnish, 3 to 5 hr.

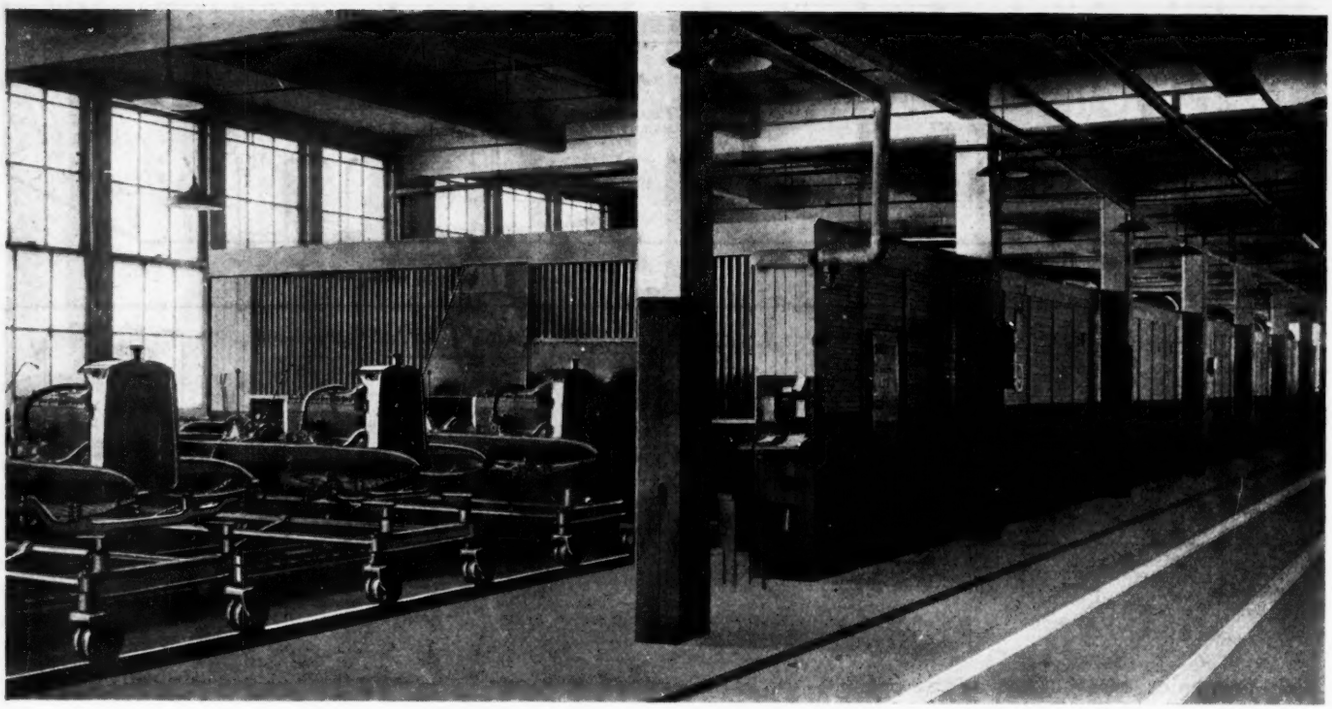
Enclosed Bodies

Enclosed bodies require a relatively longer time because of the great amount of woodwork and it is possible, of course, to use a somewhat higher temperature and consequently to increase the speed of drying on all metal touring car bodies.

The drying equipment furnished by Drying Systems, Inc., consists of a fan, radiator, air washer, humidifier, automatic temperature control, automatic humidity control, steam and water piping. The atmospheric air is brought out and put through the washer, which removes the dirt and humidifies the air. The heat is imparted to the air by cast iron radiators for pressures up to 30 lb. and specially designed pipe coil radiators for higher pressures. Automatic thermostatic temperature control and automatic humidity control is employed and with the installation there is a system of supply and vent ducts to produce the correct circulation of air in the drying room or oven. This is necessary to insure uniform and rapid drying in all parts of the dry room. Closed bodies are usually placed horizontally, while the open bodies are placed verticaly and up-ended so as to give space in each oven for as may bodies as possible.

In chassis work the ovens can be installed along the production line so that the chassis pass through the oven on the regular assembly chain. Such an installation is shown in one of the accompanying cuts.

As regards the best layout for a paint shop, it is impossible to give an ideal condition, as so much depends on



Oven installation at the Chalmers plant for drying paint on the chassis as it progresses along the assembly line

the quantity of the product which is going through. The bodies, of course, would first receive their cleaning up and priming coats, then probably a coat of lead, then a glaze and putty, the various rough stuff coats and, after that, the various color varnish and finish coats. The most efficient way of handling this is to have the bodies progressing on toward the finishing room, as each of these steps take place, so that bodies are coming out of one oven and passing on to the next, then on to the next series of operations in a following oven, and eventually to the finishing room. Whether or not bodies go back into the same oven depends upon the quantity of work going through and the space available. Some diagrams of proposed paint shop layouts are given herewith and they are deserving of study as good examples of what can be done to make the paint and trim work a real progressive job.

With the large number of operations on some of the higher priced jobs, the best possible speed that can be obtained is 11 days, not counting the time for trimming. Before the introduction of drying equipment, it would take from 22 to 30 days to do this same work. Lower priced cars do not have a finishing schedule nearly as long as the high grade varnishes, as, for instance, on large production schedules, it is generally the practice to put on a priming coat, lead coat, putty coat, two coats of rough stuff which are then water rubbed, a ground color coat, two color varnish coats which are water rubbed, and a stripe, black off and finishing coat.

In still lower priced cars where quantity production is of the utmost importance and where high quality in finish is more or less a secondary consideration, it is the practice to merely apply a priming coat, lead coat, two rough stuff coats, a ground color coat, two color varnish coats and a finishing coat. Jobs of this nature can be put through in from 4 to 5 days.

Variations

Practically every color varnish used has a different temperature and humidity at which it dries best. Green jobs, paint men say, will stand relatively high temperatures in the neighborhood of 150 to 200 deg., light blues and whites, which are very delicate, will not stand temperatures in excess of 140 deg. Black enamel jobs, such as those used on Dodge and Willys-Overland cars, are three-coated and baked from 35 min. to 1 hr. at from 425 to 450 deg. These are known as enamel jobs and the finish is relatively inexpensive, but the high temperature baking and the quick drying time resulting therefrom cannot be carried out except with black colors.

The proper laying out of the paint job for efficient operation is of tremendous importance to a manufacturer of any product which has to be painted and delivered to the purchaser with a high grade finish. It is possible to spend a great deal of money in this department of manufacture and then achieve only mediocre results. On the other hand, by a careful analysis of the problem, it is possible to secure highly satisfactory results at a minimum expense and even save a considerable amount of money on the parts tied up in process in this department. When it is possible to cut a schedule from 22 days down to 11 days the money represented by the saving is considerable.

Schedules of Operation

The appended tables show the time required, temperature, humidity, etc., for drying the various coats given under the schedules used by manufacturers of cars in different price classes.

MEDIUM PRICED CARS

For colors such as green, which will stand temperature from 160 deg. to 180 deg.

Prime and lead coat	1 day
Putty, first and second R. S.	1 day
Oil, sand, ground color	1 day
First and second color varnish	1 day
Water rub and trim	1 day
Finish	1 day

LOW PRICED CARS
(Fast Schedule)

Prime coat	3	hr.	3 hr.
Lead	2	hr.	2 hr.
First and second R. S.	each 1½	hr.	3 hr.
First and second color varnish	each 1½	hr.	3 hr.
Finish	6	hr.	6 hr.

Total time from prime to finish, including trim, 3½ days.

On all of these fast schedules the drying is accomplished by means of air washing and humidifying equipment in which is employed a very large volume of air, as otherwise if it is attempted to do it with an equipment in which there is only the normal rate of air change, the coating will surface harden.

The relative humidity at temperatures of 160 deg. to 200 deg. runs in the neighborhood of 22 per cent to 30 per cent, whereas from 160 deg. to 120 deg. it runs from 30 per cent to 45 per cent, but the actual amount of moisture in the air for these higher temperatures is very great, otherwise the surface would case harden almost immediately by coming in contact with the large volume of extremely warm air.

DRYING SCHEDULE OF HIGH GRADE CAR

Prime		Sealer coat,	
Lead	1 day	color coat	1 day
Putty glaze,		Egg shell,	
First R. S.	1 day	First C. V.,	
Second R. S.,		Second C. V.	2 days
Third R. S.	1 day	Rub,	
Fourth R. S.,		Third C. V.,	
Fifth R. S.	1 day	Rub	2 days
Rub out,		Black off,	
Ground coat	1 day	Finish	1 day

This is an 11-day schedule without including time for trimming. The temperature, humidity, and drying time are as follows:

	Temperature, Degrees	Humidity, Per Cent	Drying Time
Prime	120-130	30-35	4-6 hr.
Lead	120-130	30-35	4-6
Putty glaze	120-130	30-35	3-6
First R. S.	120-130	30-35	3-5 hr.
Second R. S.	120-130	30-35	3-5
Third R. S.	120-130	30-35	3-5
Fourth R. S.	120-130	30-35	3-5
Fifth R. S.	120-130	30-35	3-5
Ground coat	125-130	30-35	2-4
Sealer coat	125-130	30-35	3-5
Color coat	125-130	30 35	2-4
Egg shell	125-130	30-35	3-5
First C. V.	120	37-42	4-6
Second C. V.	120	37-42	4-6
Third C. V.	120	37-42	4-6
Black off and stripe	110	40-45	2-4
Finish varnish	100-104	45-50	10 hr. or overnight

SCHEDULE FOR VERY HIGH GRADE WORK

	Temperature, Degrees	Humidity, Per Cent	Drying Time
Prime	120-125	30-35	8 hr.
Half and half	120-125	30-35	8 hr.
Putty coat	120-125	30-35	4-5
First R. S.	115-120	35-40	4-5
Second R. S.	115-120	35-40	4-5
Third R. S.	115-120	35-40	4-5
Fourth R. S.	115-120	35-40	4-5
Preparation coat	115-115	35-40	3-4
Color coat	110-115	35-40	3-4
First C. V.	100-105	40-45	8
Second C. V.	100-105	40-45	8
Third C. V.	100-105	40-45	8
Finish Varn.	90- 90	45-50	24

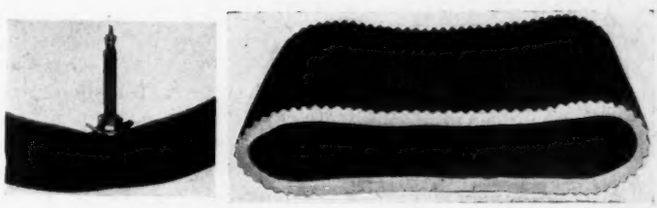
There is a rubbing operation between the second and third color varnish coats and also after the third color varnish coat.

New Tube Has No Splice

A NEW tube having a corrugated outer surface moulded in one piece without splice is shortly to be marketed through the Edward A. Cassidy Co., Inc. It will be manufactured under Fairchild patents by the Corrugated Rubber Corp.

The corrugated inner tube is moulded in a ring of oval cross-section, without splices, seams or creases. The valve is vulcanized directly into this ring and thoroughly reinforced. Circumferential corrugations maintain air spaces between the tube and the casing, and are said to prevent overheating and freezing of the tube to the casing. The tube is so made that it floats free from the rim before inflation, preventing pinching. No vulcanizing accelerators are used in its production. Corrugated tubes are said to require only five operations in manufacture. Extra heavy red antimony rubber is used. All tubes are made to conform to Government specifications covering thickness of wall, tensile strength and elastic limit.

In manufacturing the rubber is first broken down, made soft, and compounded with antimony. It is then put through a tubing machine, adjustable as to size and wall thickness. It is then in plastic form, but firm enough to be easily handled and shaped. It is cut to length, bent in a circle and formed. Valve, inner ring and base patch are inserted from inside of tube, the ends are then joined and kneaded together and the outer base patch added. The tube, now completely formed while the rubber is soft, is placed in a vulcanizing mold and as heat is applied to the outside hot vulcanizing gas under high pressure, is automatically applied to the inside of tube. The pressure forces the rubber against the surface of the mold, thus forming the tube to the desired shape. The vulcanization is said to require but twenty minutes as against seventy minutes with old processes. The mold is then opened and the finished tube removed.



Sectional and side views of the corrugated tube molded without splice

THE Gloucestershire Aircraft Company, Limited, has completed a design for a cargo-carrying machine of high capacity.

"This is a tractor-biplane fitted with a Rolls-Royce 'Eagle' engine. The wings of the upper plane are larger in area and thicker in section than those of the lower plane, and the petrol tanks are fitted inside them. The fuselage of the machine is in three sections. The leading one takes the engine, the middle one the cabin, and the rear one, which carries the tail and skid, is hinged on to the cabin section, so that it can be turned at right angles to the rest of the fuselage. By this means cargo can be taken aboard with great ease. By means of a gangway hinged to the cabin floor loading trolleys can be wheeled right into the aeroplane.

The machine has a goods load of 1600 lb. Its ceiling is 14,000 ft., and its air endurance is four hours and three-quarters at a cruising speed of 92 miles an hour."

State Regulation of State Motor Vehicle Common Carriers

Motor vehicles which are classed as common carriers have been subject to State regulation during recent years. This article gives a detailed survey of the regulations now in force, together with a critical analysis of the character of State control. Facts concern automotive manufacturers.

By Harry Meixell.*

UNTIL a few years ago the legislatures of our forty-eight States in no way differentiated between these various uses of the motor vehicle in the laws which they enacted dealing with operating requirements, registration fees and the many other subjects which are usually found in a State's motor vehicle laws.

In 1914, however, Pennsylvania definitely segregated motor vehicles when used as common carriers and placed them under the regulation of the State's Public Service Commission. To-day the laws of twenty-two States provide for a greater or less degree of such State control.

On following pages is a tabulation setting forth a digest of the more important matters which through the year 1921 had been made the subject of those State laws specifically enacted to bring motor vehicle common carriers under State control and regulation. This tabulation should be carefully considered in connection with the following discussion of the data which it contains.

Without exception State regulation of motor vehicle common carriers has been vested by law in pre-existing State agencies that exercise control over other forms of common carriers such as railroads, trolleys, telephone and telegraph lines, pipe lines, etc. The third column of the tabulation shows that these agencies have consisted of State Public Utilities or Public Service Commissions, Railroad Commissions, the Commerce Commission as in the case of Illinois, the State Tax Commission of Alabama, the Arizona Corporation Commission, or even the State Road Commission as in West Virginia.

In some instances these pre-existing State agencies have assumed control over motor vehicle common carriers by virtue of the broad general powers of the law establishing the Commissions.

In its broadest conception a motor vehicle common carrier is one that passes any and everywhere over the highways, indiscriminately transporting for a consideration all persons who present themselves as passengers or carrying all commodities or classes of commodities offered. Obviously this involves interstate transportation. The Federal Interstate Commerce Act takes no specific cognizance of the matter, however, so the application of control by the various States is in no way guided or modified by Federal laws on the subject.

A few States deal with the subject merely from the standpoint of local control, the incorporated municipalities being given power by the State Legislature to require motor vehicle common carriers to obtain permission and a license for the purpose from the local governing body. This is the case in Massachusetts, where the Board of Selectmen or City Council exercise control over motor vehicle common carriers transporting passengers.

As for State control this expresses itself in two ways: On the one hand there is a State law whose provisions give to some State agency broad general powers of control over motor vehicle common carriers. On the other hand, for the execution of these powers, the agency is permitted to promulgate and enforce such rules and regulations as it may deem necessary, express stipulation being made in some of the State laws on the subject that these rules and regulations shall take precedence over municipal ordinances.

The various laws establishing and defining this State control have in many cases, however, greatly narrowed its application. For instance, while most of the States which have dealt with the subject allow their respective State agencies to regulate both passenger and property transportation by motor vehicle common carriers, Alabama, Connecticut, Maine, New Hampshire and others limit this power to passenger transportation only.

Then, again, while most of the regulating States apply their powers of control to carriers operating within, into, and out from the limits of incorporated municipalities, California, Ohio and Oregon merely exercise authority over such transportation as is not confined solely to the limits of a city, town or other similar form of incorporated municipality.

As another and final illustration most State laws regulating motor vehicle common carriers narrow the scope of such control to vehicles operating "between fixed termini or over a regular route." In the Arizona law this expression is defined to mean the termini between which or the route over which a carrier usually or ordinarily operates his motor vehicle, "even though there may be departures from said termini or route, whether such departures be periodic or irregular." As a rule it is made a question of fact for the State agency exercising control to determine if the carrier is operating "between fixed termini or over a regular route."

With very few exceptions the powers wielded by the Public Service Commissions or similar forms of State agencies over common carrier transportation by motor vehicles are extremely numerous and broad. A consultation of the chart shows that these powers can be listed as follows:

(1) Grant, refuse to grant, amend or revoke Certificates of Public Convenience and Necessity.
(2) Prescribe routes.
(3) Fix schedules.

*Secretary of the Motor Vehicle Conference Committee of the American Automobile Association, Motor and Accessory Manufacturers' Association, National Automobile Chamber of Commerce, National Auto Dealers' Association, Rubber Association of America and Trailer Manufacturers' Association of America.

(4) Determine character of service and promote the comfort and safety of traveling public.

(5) Establish fares and rates.

(6) Require reports and uniform methods of accounting.

(7) Examine accounts and records.

(8) Supervise fiscal affairs such as incorporation, capitalization of stock, etc.

(9) Compel additions to, extensions of or betterments in physical equipment.

It is apparent that these powers are practically unlimited and of such a nature that the State agency has almost absolute control over the life or death of motor transportation within its jurisdiction. Nevertheless all of the rulings of the various commissions are subject to review by the proper courts and aggrieved parties can easily and freely appeal to them for redress of wrongs or supposed wrongs.

Furthermore, in the all-important matter of Certificates of Public Convenience and Necessity, decisions are usually made contingent on public hearings at which applicants for such certificates, other agencies of transportation serving the same territory and the general public are given full opportunity to present facts and opinions on the subject.

Up to this point in the discussion the entire subject has been approached from the standpoint of the State's power. It is now desirable to look at the question from the side of the operator of a motor vehicle common carrier, especially to learn what steps he must take in order, either to stay in business after a State adopts the policy of regulation or enter the business anew.

THE motive of this discussion of State regulation of motor vehicles used for hire is for information only. It is not intended as favoring either one side or the other of the question. The Motor Vehicle Conference Committee will appreciate any comments or arguments pro and con that readers of the article may care to advance. The purpose of the article is to lay before those interested facts and arguments which will facilitate the passage of only such laws as are scientifically correct and fair to all concerned.

In a few States, as New Hampshire, for instance, it is only necessary for the operator to obtain a permit from the State authority. This is the rare exception, however, rather than the rule. In nearly every other State a Certificate of Public Convenience and Necessity is required; while in Colorado, New York and Wisconsin a permit from the governing bodies of the municipalities in which the common carrier seeks to operate must also be secured.

In several States motor vehicle common carriers established at the time the law first went into effect have been expressly exempted from this requirement making it necessary for none but operators beginning business after the passage of the law to obtain Certificates of Public Convenience and Necessity. In Connecticut, however, and in general in every other State, established, as well as new motor vehicle common carriers, have been obliged to demonstrate to the State agency their right to exist after the State control act has been written into the statute books. Obviously, this has very often meant real hardship to those who have invested substantial sums of money in motor vehicles and have built up paying businesses over certain routes only to be obliged to abandon everything under State regulations.

Another usual prerequisite to the operation of motor vehicle common carriers has been the necessity of taking out indemnity bonds for the payment of any claims that may arise from any injury caused to persons or damage done to property by the carrier. In general the conditions of these indemnity bonds and sometimes their amounts are left to the State agency to determine. Frequently, however, the amounts are fixed by law as in Washington, where $5,000 to $10,000 is prescribed for indemnification of claims arising from injury to persons and $1,000 for damage to property.

While in the imposition of annual registration fees and other forms of taxes upon motor vehicles, State legislatures have in only a few cases discriminated between motor vehicle common carriers and private carriers, nevertheless, they have drawn a sharp line between motor vehicles used privately by their owners and those operated for hire.

Any discussion of State regulation of the motor vehicle when used as a common carrier would be incomplete without reference to the arguments for and against such regulation. In so doing, however, the opinion frequently expressed that railroad and trolley companies, as a result of the severe competition of motor transportation, are seeking State regulation as a means of killing off such competition, will be totally disregarded, and only such arguments recorded as are predicated on public welfare, sound economics and strict impartiality.

With these premises, therefore, those who contend for State regulation say that such control is necessary:

(1) Because motor transportation for hire is a public utility, and as such should be regulated along with other public vehicles, so that travelers and shippers by such means can be made sure of safe, prompt, regular, adequate, efficient and economical service.

(2) So that, in all cases where motor vehicle common carriers come, or are likely to come, in ruinous competition with other common carriers, the State can step in and determine whether public convenience and necessity require such competition, and save, if desirable, the pre-existing agencies of transportation.

(3) In order to shoulder upon the motor vehicle common carrier obligations, financial and otherwise, in return for the rights given it to operate for a profit over all or certain highways within a State especially so since the highways are built and maintained by the public. In some cases these rights take the form of valuable franchises which virtually grant monopolistic privileges over certain routes.

(4) For the purpose of eliminating the irresponsible, so-called "fly-by-night" companies and individuals who, while undergoing certain destruction for themselves, pull down with the ruin well managed motor transportation agencies which render a real public service and are entitled to a reasonable return on their investments and a stabilization of their business.

In objection to these arguments for State regulation of the motor vehicle common carrier, opponents of the proposition maintain:

(1) That granted motor transportation for hire is a public utility, public interest can best be served by unrestricted competition and complete freedom from regulation in which none but the fittest can survive. This policy they contend will yield to passengers and shippers the maximum of results with the minimum of cost.

They deny any analogy between motor vehicle common carriers and railroad and trolley transportation agencies, pointing out that the latter by virtue of private owner-

Summary of Salient Features of State Laws Regulating Motor Vehicle Common Carriers

State	Law in Effect	State Agency Exercising Control	Application of Control	Prerequisites of Operation	General Powers of State Agency, Etc.	Special or Extra State Taxes
Alabama	1919	State Tax Commission.	Passenger transportation only. Within, out from and into municipalities.	Filing of written statement showing terminal points of routes to be covered. Obtaining of special license.	x	In lieu of regular registration fees, the following Seating capacity 5 pass. or less $37.50 Seating capacity over 5 pass., less than 10 60.00 Seating capacity over 10 pass 90.00
Arizona	1919	Corporation Comsion.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by Commission.	General control over granting of Certificate of Public Convenience and Necessity; regulating service; fixing rates and fares.	x
Arkansas	x	x	x	x	x	x
California	1917	Railroad Commission.	Passenger and property transportation. Out from and into municipalities only.	Certificate of Public Convenience and Necessity.	Grant, refuse, suspend, revoke or amend Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares, supervise fiscal affairs; authorize sale or lease of certificates.	x
Colorado	1915	Public Utilities Commission.	Passenger and property transportation. Within, out from and into municipalities.	Permission from municipalities to operate. Certificate of Public Convenience and Necessity.	Wide control over issuance of Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares; promote health, safety and convenience of operation. Municipalities may purchase and operate motor vehicle common carriers.	Special registration fees for passenger carrying motor vehicle: Seating 9 passengers or less, $20; for each additional seat of capacity, $1.
Connecticut	1921	Public Utilities Commission.	Passenger transportation only. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity insurance based on seating capacity; range $5,000 to $10,000 per vehicle.	Grant or withhold Certificate of Public Convenience and Necessity. Street railroad companies may acquire, own and operate motor vehicles for hire.	Extra registration fees as follows: Regular fees plus $15 for vehicle with seating capacity of 5 or less; over 5 but under 21, $2 per seat over 5; 21 but under 41, $5 per seat over 20; 41 or over, $10 per seat over 40.
Delaware	x	x	x	x	x	x
Florida	x	x	x	x	x	Special registration fees: For passenger carrying vehicle: seating capacity 7 or less, $5 per seat; over 7 but less than 17, $7.50 per seat; 17 or over, $10 per seat in addition to 75c per 100 lbs. gross weight of vehicle and load. For property carrying vehicles, $1.50 per 100 lbs. gross weight on pneumatic tires; $2.25 per 100 lbs. on solid tires.
Georgia	1907	Railroad Commission.	x	x	The Commission holds that it has jurisdiction over motor vehicle common carriers, but has not as yet had occasion to exercise this power.	Special registration fees for passenger carrying vehicles with a seating capacity of ten or more, $75.
Idaho	x	x	x	x	x	x
Illinois	1921	Commerce Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Adequate indemnity insurance or sworn statement of ability to meet any possible damage claims.	Grant, refuse, alter, modify Certificates of Public Convenience and Necessity. Regulate rates, fares, service, contracts, practices, etc.	Extra state tax on property carrying vehicles not operated exclusively within a municipality. Gross weight 12,000 lbs. or less, 1c per mile; over 12,000 lbs., 2c per mile. On passenger carrying vehicles gross weight 12,000 lbs. or less, 1/15c; over 12,000 but not more than 15,000 lbs., 1/5c; over 15,000 lbs., 1/4c per mile.
Indiana	x	x	x	x	x	x
Iowa	x	x	x	x	x	x
Kansas	x	x	x	x	x	x
Kentucky	x	x	x	x	x	x
*Louisiana	x	x	x	x	x	x
Maine	1921	Public Utilities Commission.	Passenger transportation only. Within, out from and into municipalities.	Certificate of Permission.	Make rules and regulations governing operation; fix fares, regulate routes and schedules, etc.	Extra State Registration fee amounting to double normal fee.
*Maryland	1916	Public Service Commission.	Passenger and property transportation, Within, out from and into municipalities.	Annual permit.	Grant or refuse permits. Make rules and regulations governing operation. Fix rates, fares, schedules, etc. Provide for safety and convenience of traveling and shipping public.	x
Massachusetts	x	x	x	x	x	x
Michigan	x	x	x	x	x	x
Minnesota	x	x	x	x	x	25% extra registration fee for property carrying motor vehicles and passenger carrying motor vehicles seating more than seven passengers.
Mississippi	x	x	x	x	x	x
Missouri	x	x	x	x	x	x
Montana	x	x	x	x	x	x
Nebraska	1919	State Railway Commission.	Commission has only asserted jurisdiction over property transportation out from and into municipalities.	x	Commission in 1919 issued an order affecting rates and classifications of property carried by motor vehicle common carriers out from and into municipalities. Order rescinded in 1921.	x

State	Law in Effect	State Agency Exercising Control	Application of Control	Prerequisites of Operation	General Powers of State Agency, Etc.	Special or Extra State Taxes
Nevada	1919	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond not less than $500 nor more than $10,000 per vehicle.	Issued or withhold Certificate of Public Convenience and Necessity. Regulate fares, rates, schedules, classifications. Examine books and records; prescribe service; order improvements, additions, etc.	Extra annual tax of $2 per 100 pounds gross weight for operating on first class highways. $1 per 100 pounds on second class; 25c per 100 pounds on other than 1st and 2nd class.
New Hampshire	1919	Public Service Commission.	Passenger transportation only. Within, out from and into municipalities.	Permit to operate. Indemnity bond of $500 per vehicle plus $100 per person of seating capacity.	Grant or refuse permits. Establish reasonable rules and regulations governing operation.	x
New Jersey	1921	Board of Public Utilities.	Passenger transportation only and solely where it parallels street railway lines. Within, out from and into municipalities. Only applicable to lines established after March 15, 1921.	Indemnity bond of $5,000 by municipalities in which lines operate.	General supervision, regulation and jurisdiction in the matter of rates, fares, schedules, service, etc.	Special registration fees as follows: 5 passenger or less; $15; 6 to 8 persons, $17.50; 9 to 12 passengers, $20; 13 to 17 passengers, $25; 18 to 22 passengers, $30; 23 to 26 passengers, $35; 27 to 30 passengers, $40; over 30 passengers, $40; plus $2 per seat in excess of 30.
New Mexico	x	x	x	x	x	x
New York	1915	Public Service Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	General jurisdiction over rates, fares, schedules, service, etc.	Special registration fees as follows: 5 pass. or less..$15.00 21-22 pass....$55.00 6- 7 pass.... 24.50 23-26 pass.....61.50 8-10 pass.... 30.50 27-30 pass..... 67.50 11-16 pass.... 43.00 Over 30 pass... 67.50 17-20 pass.... 52.00 plus $2 per pass. over 30. Schedule not applicable to omnibus operating wholly within municipality under franchise granted by said municipality.
North Carolina	x	x	x	x	x	Extra registration fee of 50% over normal fee.
North Dakota	1919	Board of Railroad Commissioners.	Passenger and property transportation. Within, out from and into municipalities.	x	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Extra registration fee for passenger carrying vehicles, 25c per passenger of seating capacity allowing 16 inches of seating space per passenger.
Ohio	1921	Public Service Commission.	Passenger transportation only. Out from and into municipalities only.	x	Fix fares; exercise general supervision over the operation of the carrier, regulate general relationship between carrier and public.	x
Oklahoma	x	x	x	x	x	x
Oregon	1920	Public Service Commission.	Passenger and property transportation. Out from and into municipalities only.	Certificate setting forth special terms and conditions under which operation is permitted. Indemnity bonds as conditioned by the Commission.	Supervisory and regulatory powers on all matters affecting the relationship of carriers with passengers and shippers. Fix reasonable rates, fares, charges, service, facilities, etc. Supervise and regulate accounts; require reports, data, etc.	For passenger carriers extra registration fee of $4 per passenger allowing 20 inches for seating space per passenger. For property carriers extra registration fee of 50c per inch of total tire width. In addition for both passenger and property carriers an annual fee for administration of motor vehicle common carrier laws of not more than $10 per vehicle.
Pennsylvania	1914	Public Service Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	x
Rhode Island	x	x	x	x	x	Extra registration fee of 100% over normal fee.
South Carolina	x	x	x	x	x	x
South Dakota	x	x	x	x	x	x
Tennessee	x	x	x	x	x	x
Texas	x	x	x	x	x	x
*Utah	1918	Public Utilities Commission.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	General Supervision and regulation. Fix rates, fares, tolls, rentals, charges and classifications; regulate practices, facilities and methods. Establish uniform accounting; make investigations; require reports, etc.	x
Vermont	x	x	x	x	x	x
Virginia	x	x	x	x	x	Extra annual tax of $5 per vehicle in cities and towns of less than 5000 population; $10 per vehicle where population is 5000 or over.
Washington	1921	Department of Public Works.	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond $5,000 to $10,000 per vehicle for injury to persons; not over $1,000 for damage to property.	Grant, refuse, suspend, revoke, alter, amend Certificate of Public Convenience and Necessity; fix proper rates, fares, charges, classifications, regulations. Prescribe equipment service and safety of operation. Regulate accounts; require reports, etc.	Extra annual registration fees: Passenger carriers for vehicles with seating capacity of 8 or less, $10; 50c per passenger over 8. For property carriers, $10 for vehicle of 3 tons or less capacity; $1 per ton of capacity over 3 tons.
West Virginia	1921	State Road Commission.	Passenger and property transportation. Within, out from and into municipalities.	Permit to operate.	Grant permits although no discretionary power is vested in Commission. Classify vehicles and fix their privilege taxes.	For passenger carriers extra registration fee roughly 100% greater than normal annual fees.
Wisconsin	1915	Railroad Commission.	Passenger transportation only. Within, out from and into municipalities.	Consent of Municipality Indemnity bonds as fixed and approved by the Commission.	Determine adequacy and reasonableness of fares, routes and service. District Attorney authorized to enforce rules laid down by Commission.	Special fee for passenger carriers operating wholly within a municipality, $10 per vehicle which is in lieu of regular fee.
Wyoming	x	x	x	x	x	x

*Since these tables were made up the following information under "Special or Extra State Taxes" has come in:

LOUISIANA
Special registration fee for passenger carriers: 68c. per hp., plus $2 per passenger up to 8; $3 per passenger, 8-25; $5 per passenger over 25.

MARYLAND
Special fee, $1.20 per hp.

TEXAS
Carrying persons or property for hire between municipalities, $32 to $160, plus ½c. to 4c. per mile traveled according to net carrying capacity.

ship of franchises, rights of way, road beds, tracks and terminals have an exclusive and monopolistic control over all transportation on their routes. Motor truck operators, on the other hand, even where granted a monopoly of transportation for hire over a certain prescribed highway or portion thereof cannot deny the use of that highway to others who wish for themselves or as private carriers to transport persons or property over those same routes.

Finally, they point out that governmental regulation of rail and trolley common carriers came after these agencies had abused their rights and privileges and through pools, stifling of competition, exorbitant increase of rates, discrimination, stock watering, etc., made it necessary for the public in self-protection to subject them to control. By the very nature of the service these evils are impossible with motor transportation, since the road is free to the use of everyone and motor vehicles the medium for transportation over the roads are quickly, cheaply and in unlimited numbers available for everyone.

(2) Since the obvious outcome of the first argument advanced against State regulation is "cut-throat" competition between various forms of transportation attempting to serve a certain territory and *per se* between the motor transportation companies themselves operating in competition over certain highway routes, the opponents of State regulation cannot escape the query whether they are willing to face the logical consequences of such a struggle. Without hesitation they answer that wherever rail, trolley or any other form of transportation for hire cannot stand up before a newer and better form, public interest demands that it should give way; likewise within that newer and better form of transportation, the rule should be survival of none but the most efficient and economical agencies. They are confident that even though such a policy may mean the destruction at times of more or less invested capital, as it did when rail and inland water transportation first came into acute competition, the final economic benefits to the community as a whole will many times compensate for the loss involved.

(3) As for shouldering upon motor transportation for hire financial and other burdens which it should rightly carry, opponents of State regulation say that legislative bodies have not heretofore found it necessary to establish such control in order to determine the weight limits for motor vehicles used as common carriers; their registration fees and other charges; their liability to the public for injury to persons or damage to property, etc. If this is all that is involved it is not sufficient to warrant almost unlimited regulation in all other respects by a State agency.

(4) Lastly, those against State regulation believe that the natural working out of economic laws will do more to stabilize the motor transportation for hire business than extensive interference on the part of governmental agencies of any sort. They feel that the proposition is paternalistic and will result either in discrimination in favor of one or more types of transportation, and against all the rest, or else that it will promote monopolistic advantages for certain motor transportation companies, and that through it all the traveling and shipping public will pay the cost.

In even-numbered years the activities of State legislatures are relatively light, since no more than eleven or twelve State law-making bodies get together in regular session, while few of the others meet in special session. Notwithstanding this fact 1922 is producing a big crop of bills dealing with motor vehicle common carriers. The Arizona State Legislature now in special session and the current regular sessions of the Maryland, New Jersey and New York State legislatures are considering extensions of the existing powers of their State agencies exercising control over motor vehicle common carriers. On the other hand, in Kentucky, Massachusetts, Mississippi, Rhode Island, South Carolina and Virginia, where the State legislatures are in regular session, and where as yet there is no such regulation, many measures aiming to bring about a greater or less amount of such control are now receiving the careful consideration of the legislators.

In this connection it is interesting to note that in New Jersey the strongest and most active opponents of State regulation and the extension thereof, have introduced and are striving to bring about exclusive power in the premises for the local incorporated municipalities. Apart from any other arguments pro and con for such local control, it must be apparent that the operation of a motor vehicle common carrier beyond the confines of a single municipal jurisdiction of a State becomes extremely complicated and burdensome under such circumstances and is likely to suffer from the varying policies of constantly shifting local governing bodies.

Another interesting movement to note in some States is proposed legislation to require every common carrier motor vehicle engaged in the transportation of passengers to have both a front and rear entrance, while in Maryland a pending measure would require not only a chauffeur but also a conductor on every such vehicle. This would seem to indicate that some State law-makers seek to rewrite in motor-bus transportation the full crew laws which for a long time have been an economic burden for the railroads.

The motive of this discussion of State regulation of motor vehicles used for hire is informative only. It is not intended and in no way must be regarded as favoring either one side or the other of the question. For this reason the conference committee will appreciate greatly any information; arguments pro and con; comments; corrections or criticisms which all those who read this discussion may have to offer, especially if such material includes the practical experiences that have resulted from regulation by the States where it is now in force. How important this is can be seen from the fact that in 1923 the legislators of forty-two States will meet in regular session and doubtless be called upon to make decisions on scores of bills vital to motor vehicle common carriers. The conference committee hopes at that time to be of service in laying before all concerned facts and arguments which will facilitate the passage of only such laws as are scientifically correct and fair to motor vehicle common carriers; competing common carriers and the public.

IT is doubtless known what effect the Townsend law providing Federal road aid in the United States is having to build up our own highways. Brazil has just approved and adopted a similar law, according to a statement from Ambassador Morgen at Rio de Janeiro, stating that an executive decree on Jan. 11, 1922, made effective the law authorizing federal subsidies up to 50 per cent for the improvement and maintainence of roads and highways. The improvement work will be done by the various states of Brazil, and the federal government will reimburse them by 50 per cent of the cost.

This is probably the most significant step yet taken in any country of Latin-America looking to the improvement of roads. The exchange rate in Brazil is temporarily down but it has been pointing upward for some weeks and is now considerably above the low point reached during the latter part of 1921. Brazil already has built many roads, as has been shown in previous bulletins, and with this new federal road aid the possibilities in Brazil appear tremendous.

Standard Valve Stems

Editor, AUTOMOTIVE INDUSTRIES:

1. Referring to the bulletin of the Goodyear Tire & Rubber Co., mentioned in AUTOMOTIVE INDUSTRIES of Feb. 9, 1922, and sent by them to the Tire and Rim Association, regarding a standard valve stem for disk wheels that would enable access to be had to the valve for inflating the same from the front side of the disk wheel, is not the real problem a universal or standard valve stem for all types of wheels accessible from the front of all wheels?

2. As is well known, any disk wheel with the valve stem on the back side of the disk is very impractical. While it may be temporarily so used, unless its position is changed it will kill the disk wheel and prevent its extensive use, and, as pointed out, the continued use of the disk wheel leads to the use of a multiplicity of makeshift devices, all more or less impractical.

3. This is a question of valve stems and not valves, as stated in the bulletin, and these must not be confused. In the bulletin the suggestion is made to "standardize on one type of valve," whereas in reality one type of valve stem is meant; for, as a matter of fact, the valve *per se* is always the same and standard, and the only thing that changes is the length of the valve stem itself, which is naturally modified with all the various sizes and types of wheels used, whether these are of the wood-spoke, demountable-rim type with felloe band, the wire-wheel, or the disk detachable type without felloe band.

4. At present, to meet these various conditions, it requires for the various sizes of tubes six or seven different lengths of valve stems and at least two or three different lengths of valve stems are used in each size of tube, requiring tire makers' dealers to stock two or three different tubes of each wheel size and tube diameter.

5. Added to the above is now the further suggested complication of a valve stem construction that will give accessibility for inflation from the front of the disk wheel, and which, if met in any of the ways suggested, by adopting any device solely applicable to disk wheels, must lead to many more complications, and, as pointed out in the bulletin, may result in each disk wheel maker adopting a special device to suit his individual construction.

6. The construction of the various makes of disk wheels varies to such an extent that any form of valve accessibility that touches the disk itself is impossible unless all disk wheels are of one design, and any suggested standard valve stem must be based upon a predetermined shape and position of the disk relative to the center line of the wheel, and this is impossible without complete and detail standardization of the disk wheel itself.

7. The only completely standardized element of wheel construction, whether the wheel is of the wood-spoke, demountable-rim, wire-wheel, detachable, or disk-wheel detachable type, is the standard rim, and it is necessary to standardize the valve stem relative to the rim only and define and standardize its length and position relative to the standard rim only.

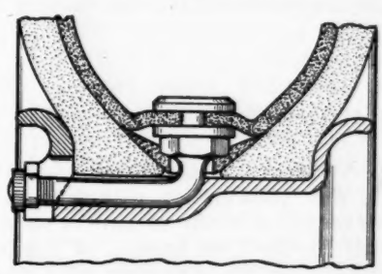
8. In this case the valve stem will be accessible for inflation from the front face of the rim, in a thoroughly protected position, and identically located for all types of wheels, and without the necessity of delving in between wood or wire spokes or behind the disk of the disk wheel. (See accompanying cut.)

9. An absolutely standard valve stem for each size of rim or tire or tube would give the following results:

(a) A single standard valve stem for each size of rim or tire or tube and every 3½-in. tube and valve stem would always be the same, and only one type of 30 x 3½-in. tube would be made by the tire maker and carried in stock by the dealer instead of two or three as at present.

(b) As the valve stem is accessible from the front of the rim, the ease of accessibility is independent of the number of spokes and the depth of the rim, and the 40 x 8-in. valve stem is quite as accessible as 30 x 3½-in. stem, and both are much more easily accessible than the present valve.

(c) The tire with tube and valve stem complete would be much more easily mounted on the rim, as it could be pushed straight upon the rim and not angled over the rim, and is the only form of valve stem that is practical for the larger sizes of tires, and, in the case of demountable rims, would not require a hole through the felloe band, and, in the case of the larger sizes of tires, a cut-away slot in felloe to or beyond the center for the present valve stem to allow the rim to be mounted, causing a great weakening of the felloe band.



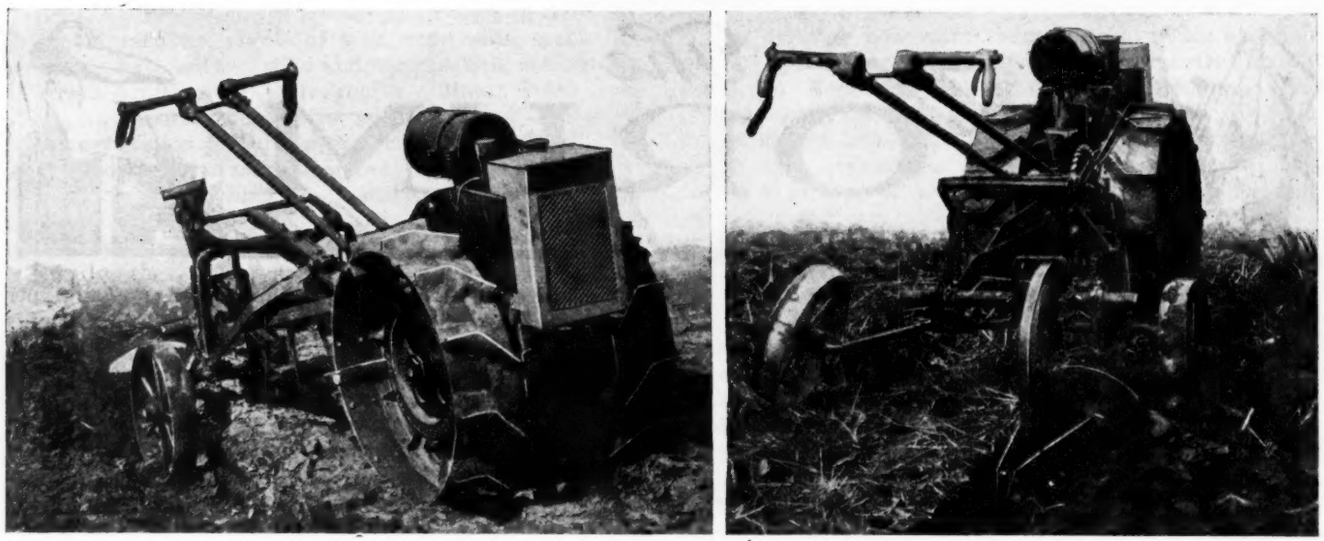
Sectional view of tire stem, showing location of bent valve stem and accessibility

(d) This standard valve stem would be 10 to 20 per cent cheaper than the present valve stem and would be much more convenient in every way, especially as the complete tube, in its packed or collapsed state, would require less space and will be more compactly packed into the box and might use a smaller size box.

(e) This standardization would ultimately result in other great savings and economies and be of great value to all users of pneumatic tires, both the automobile makers and the ultimate consumer.

10. The adoption of the proposed standard could be quickly brought about by the tire makers without any increased expense to themselves or the ultimate consumer, and without any complication or expense in any "interim period," during which both types of valve stems might be required, as either system could be arranged to interchange on all existing types of wheels.

11. The advantages and necessity for such a standardization are apparent, and it is up to the tire manufacturers to bring this about, as this would be to their own individual advantage as well as to the advantage of all tire users.



Two views of Beeman tractor showing anti-side draft offset plow hitch

As Sherman said, "The way to resume is to resume," and equally so, "the way to standardize valve stems is to standardize valve stems," and the greatest financial gainers will probably be the pneumatic tire makers.

W. J. P. MOORE.

Eliminating Side Draft with Garden Tractors

Editor AUTOMOTIVE INDUSTRIES:

In his recent article on Garden Tractors, Mr. Ziesenheim mentioned particularly the trouble encountered with these narrow tractors with the right bull wheel in the furrow. That, as well as many other things he says, indicates that in some way he has gained some real knowledge with reference to garden tractors, and he certainly will appreciate what we have accomplished in developing one anti-side draft offset plow hitch. We enclose herewith two photographs of one of our tractors operating with this hitch.

E. R. BEEMAN, President,
Beeman Tractor Company.

An Analysis of the Coal Situation

AN analysis, the purpose of which is to give business men information regarding possible fuel supplies in the event of a strike of miners on April 1, was issued recently by the Coal Bureau of the Natural Resources Department of the Chamber of Commerce of the United States. The bulletin carries charts covering conditions in particular localities throughout the United States.

A general summary covering the situations with which the booklet is concluded, says:

"Factors which will control supplies in case of a strike that closes the mines in union fields will be stocks on hand and output of non-union fields.

"Anthracite: As the anthracite field is 100 per cent unionized, all supplies in the event of a complete closing of the mines will have to be drawn from stocks on hand. The United States Geological Survey has published figures based on statements from 648 typical retail dealers, showing the day's supply of anthracite usually carried by them on April 1, as follows:

April 1, 1919	31 days
March 1, 1920	21 days
April 1, 1921	36 days

"If these figures should hold good for all dealers, there would be in dealers' hands, normally, on April 1 about a month's supply. The Geological Survey also give the following figures covering approximate stocks of anthracite, domestic sizes, in hands of producers Jan. 1, 1922:

	Tons
At Eastern points	2,000,000
Storage at Great Lake ports	1,000,000
By-product coke for domestic use	1,000,000
Total	4,000,000

"Assuming an equal supply on hand April 1, and assuming further, that this supply could be evenly distributed among all consumers, it would last several months, as it would be available at the beginning of the warm summer months when consumption is lightest.

"The probable disarrangement of the usual system of distribution which would result from a strike, the variation in storage capacities and stocks in storage, with the uncertainties of weather conditions make it impracticable to estimate the length of time the supplies of anthracite on hand would last.

"Bituminous: The following statement of the U. S. Geological Survey will be of interest as indicating the days' supplies of bituminous coal in the hands of various classes of consumers in the United States on Jan. 1, 1922:

	Days
By-product coke plants	42
Steel plants	48
Other industrials	51
Artificial gas plants	89
Electric utilities	51
Coal dealers—bituminous	33
Railroads (estimated from incomplete data)	35

"Subsequent statements are that supplies have increased to some extent up to Feb. 11.

"Average figures covering the entire producing and consuming areas rest on a theory of even division of product and uniform storage capacity and uniform stocks on hand throughout the country. In reality, however, such uniform conditions do not exist in the different communities. Moreover, in case of strike the ordinary lines of distribution are so disarranged that there results great variation in the ability of different communities to secure needed supplies."

Labor Problem Far from Solution

An attempt to weaken the trade unions shows an ignorance of the fundamental causes of labor trouble which previous strikes have not settled. Harmony between the employer and employee depends on the character of the organization regardless of any outside disturbances and influences.

By Harry Tipper

THE trouble with the pressmen in New York, the imminence of the strike of miners, the present strike in the textile field in New England, and reports of other strikes of more or less importance to their industries or localities, indicate how little the problem of labor has been solved by the previous strikes and how far the manufacturers are from being in a position to control the actions of the workers with any degree of efficiency in these various lines of endeavor. There is a good deal of interest in the fact that in all these strikes certain shops have been unaffected. In the pressmen's strike in New York, one of the newspapers was entirely unaffected and is not involved in the trouble as the aftermath of the strike. In the coal strike, some of the mines are not affected; in the textile strike in New England some of the mills are not affected.

These circumstances prove with renewed evidence that the individual establishment is capable of maintaining an agreement with its own employees regardless of the surrounding disagreements, if the proper organization has been built up. The amount of time lost and the money involved in the cost of these strikes is very large, but the loss of efficiency due to the difficulties created by the strikes, the bitterness resulting from the fight and the general antagonism is likely to be greater than the cost of the actual interruption of work. The difficulties of the individual establishments in avoiding strikes are not to be charged merely to the fact that they are in some cases non-union, and in many cases do not pay any attention to the union considerations. If they were notably unfair or unjust to their workers it would be a comparatively simple matter for these workers to organize themselves in order to enforce their demands. In fact, this has been done in scores of cases where there was a real grievance. In these individual establishments there is an opportunity to get together with the employees because the discussion relates to the same immediate organization and the same problems, without the interference of outside groups composed of manufacturers or workers, and officered by men who have added to the desires of members of the group their own demands and their own necessities for action. It is useless to consider the merits or demerits of these strikes. The coal miners claim that the wages have not affected the price of coal, as charged by the operators; that the operations of the mines are notably inefficient as they average only 3 to 4 days per week at work, and that the present wage is not any more than they are entitled to. The actual strike, however, has been caused by the maintenance of a stubborn attitude by both sides to the controversy, which attitude indicates that they are willing to have the matter go to a trial of strength and are not particularly anxious for an agreement. The operators have admitted through their spokesmen that their present intention is to beat the union, a victory which will be of no value either to the coal industry or the rest of the people because it will form merely a basis for future disagreement. They are evidently disinclined to compromise or to arrive at any agreement, hoping to break down the strength of the union at a time when the production of the coal product is not required to such a large extent, and when the surplus supplies are plentiful.

It would seem that the coal operators have not been particularly anxious to avert this strike and, in fact, the actions they have taken would indicate that they have themselves in a sufficiently strong position to be willing to let the matter go to a strike in order to break the strike and thereby weaken the union. It is astonishing that employers groups should learn so little from past experiences. The history of labor union development is one long record of strikes, many of which have been broken, sometimes after months of idleness. In spite of all these defeats the trade unions have grown stronger and have succeeded in securing more from the manufacturer. It is not likely that the success of the coal operators in the strike will weaken the union, and before long that fact will be evidenced in some way or another. The only way in which the unions can be weakened is by the adoption of methods that will provide a greater degree of fair play and justice to the worker than those which the union adopts.

The absence of any serious consideration of the labor question at this time is indicative of the fact that the manufacturer associates labor troubles only with the acute difficulties of strikes and interruptions. Labor is not any more satisfied than it was in 1920, and the labor unions have not receded from their position in any single point. The problem of developing a satisfied and contented organization within the factory is still up to the individual manufacturer.

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Stresses Due to the Transmission Brake

ONE of the objections often urged against the transmission brake is that it imposes greater stresses upon the propeller shaft, differentials and rear axle shafts than would otherwise occur. The reasoning behind this argument, however, is not always as clear and convincing as might be desired.

If the transmission brake is well designed it is usually an easy matter to stall the driving wheels with it, and the stress on the propeller shaft, rear axle shafts and other members of the transmission line then depends directly upon the adherence of the rubber tires to the ground. The more powerful cars and trucks are so designed that when the engine develops full power on the low gear, and especially on the reverse, there is enough torque on the drive wheels to slip them on ordinary dry road surfaces. In laying down the specifications for the Class B military truck, for instance, this was one of the points insisted upon. But there is one condition of operation under which the torque on the transmission members can be materially increased over that which the engine can produce on a steady pull. If the truck or other vehicle gets stalled on a heavy road it is a very common thing for the driver to put his gear in low, speed up the engine and let the clutch in quickly. Under such conditions, owing to the energy stored by the flywheel and the excess capacity of the clutch beyond the maximum steady torque of the engine, much greater torque can be impressed upon the drive members than in steady driving. The only thing that limits the torque transmitted under such conditions is the adherence of the drivers to the ground, and the limit on the driving torque is therefore exactly the same as the limit on the braking torque. It is true that this driving torque is abnormal, yet it is likely to occur on any truck and must be provided for in the design.

It is therefore not correct to say that the transmission brake imposes heavier stresses on the driving members than any due to the drive itself. On the other hand, the fatigue effects of the braking stresses are additional to the fatigue effects of driving stresses, and since the wheels will undoubtedly be locked by the transmission brake much oftener than they will be slipped on solid, non-slippery surface by a sudden release of the clutch, it is not unlikely that fatigue strains cause an earlier failure of the drive members if a transmission brake is used.

Percentages

THIS editorial is intended not for mathematical sharps but rather for those whose mathematical education has been neglected, if any such there be among the readers of AUTOMOTIVE INDUSTRIES. We fully believe that the great majority of our readers are thoroughly sound in their use of percentages, but, of course, the minority always has a right to consideration.

We often hear the statement that between the extreme values of a variable there may be a difference as great as — per cent. Now, a difference cannot be properly expressed as a percentage, because one can never tell whether the percentage is based on the smaller or the larger of the values. For instance, between 40 and 120 there is a difference of 80, which is 200 per cent of the smaller and 66 2/3 per cent of the larger figure. The statement might be rendered precise by saying that the difference between the extreme values may be as great as — per cent of the lower value, but it is much better to express this relation by saying that the quantity may vary between limits of the ratio of 1 to 3 (using the values of the foregoing example).

Right here it may be in order to point out that a quantity cannot be reduced by more than 100 per cent. This would seem to be obvious, yet statements in which something or other is decreased by more than 100 per cent are met with constantly—naturally less frequently in printed than in hand-written or typewritten matter, because most of the material that appears in print has been gone over by one or more editors and by one or more proofreaders after the author has finished with it. This slip sometimes occurs in unexpected places. For instance, some years ago a rather successful business man with a

college training, who was then president of a leading engineering society, in a public address made the rather surprising statement that by the introduction of improved machinery the production cost of some automobile parts had been reduced 300 and even 400 per cent.

To make percentage figures definite and comparable they must always be based on the same thing. For instance, commercial profits should always be based upon the sales price. If a dealer buys an article at 80 cents and sells it at a dollar, the profit is 20 per cent, not 25.

Some people make a habit of using the percentage method of comparing magnitudes where it is not particularly suitable. For instance, the statement may be made that, in 1920, 10,000 per cent as many automobiles were manufactured as in 1902, which is the same thing as saying that the 1920 production was 100 times as great as that of 1902. The writers who affect this style undoubtedly belong to the impressionist class and are looking for the largest possible figures to use. A small value can be conveniently expressed as a percentage of a larger one, but to express a very large value as a percentage of a small one is not advisable.

The Genesis of Service

MUCH water has gone under the automotive bridge since 1904. Volume of business has increased, design and performance have been improved immeasurably, methods of selling and service have been considerably refined. But many fundamentals are found to be the same in 1922 as in 1904.

Many of the veterans of the industry will find considerable interest in the following editorial which appeared in *Horseless Age* of Nov. 9, 1904. We ran across it the other day and it brought so much food for thought to us that we are passing it along. The editorial was headed, "The Importance of the Agent," and it read like this:

Until about four years ago, the early, successful manufacturers of automobiles declined all offers of would-be agents, as they had no difficulty in selling all the machines they could make, and did not care to pay an agent's commission. In 1901, however, the number of practical machines and the capacities of the individual manufacturers having greatly increased, most of the leading firms found it advisable to establish branches or agencies in all the large cities, and from that time on the agency has continued to grow in importance as a factor in the automobile business. At present many more cars are sold through agents than by manufacturers direct, and the product of a few large concerns is disposed of almost entirely by agents.

In any city where a considerable number of cars are represented, a manufacturer not represented and located at a distance will find it practically impossible to make a sale. The present day purchaser wants to be convinced of the merits of a car by demonstration rides, etc., and will not, as a rule, make a lengthy trip to a factory if he can inspect and test many different makes right in his own city. Then, too, there are many real advantages to the new owner in the fact that an agent for his car is conveniently located in his home town. He will receive more careful instruction in the operation of his machine, and in case of any difficulty during his early experience it will be a great aid to have the agent near to advise and assist.

Agents usually carry a considerable stock of repair parts, and a break or wearout necessitating the renewal of a part causes less delay if the part can be supplied by the agent from stock than if it had to be shipped from the factory.

Finally, in the smaller cities, if a car is bought from a dealer, well and favorably known, it is an assurance to the purchaser that he will be treated fairly in every respect, and that the manufacturer's guarantee will be lived up to. In view of these several facts, the automobile purchasing public prefer to deal with agents, and manufacturers are therefore obliged to appoint agents for all territory in which they expect to do a considerable business.

Since the local markets are thus controlled by agents, and the local business is divided among them largely in proportion to their respective business ability, reputation for integrity, etc., manufacturers are deeply concerned in securing the most capable agents in every locality. As the movement progresses, the difference in the actual value given for the money by different manufacturers will be shaved down finer and finer, and the different models will more closely approach each other in general design. This renders the choice between the different makes of cars constantly more difficult for the purchaser, and sales depend more upon the agents' ability than in the past. The capable agent is, therefore, in great demand at present, and this season, practically for the first time in the history of the industry, his services are being competed for by the leading manufacturers.

Manufacturer's Agents

WE are witnessing the entrance into the field of a new method of automobile distribution, a method which is well known in some automotive products and in other lines, but which has never been used extensively in the selling of motor cars and trucks. It is the use of a manufacturer's agent or jobber. The nearest approach to this has been the controlling of sales of the manufacturer's output by a separate company acting in conjunction, and with an interlocking of interests, with the manufacturer.

Because of the increasing necessity of studying problems relative to the marketing of motor cars and trucks, it may be well to consider the advantages and disadvantages of this method of distribution. Whether the saving accrued will outweigh the loss of personal contact between the manufacturer and the retailer remains to be seen. Many of the minor details of this form of marketing may be advantageous and applicable to the manufacturer marketing his product through his own selling organization. The method is worth analyzing.

Knudsen Takes Charge of Chevrolet

Ex-Ford Production Expert Joins G.M.C.

Election Indicates duPont Has Taken Actual Control of Corporation's Policies

DETROIT, March 27.—The election of W. S. Knudsen as vice-president in charge of operations of the Chevrolet Motor Co. and the assignment of K. W. Zimmerschied, although continuing as president, to advisory duties connected with the office of Pierre S. duPont, president of the General Motors Corp., may be defined in a measure as ushering in duPont as the real active head of the great motors combination.

duPont Has Studied Industry

Since duPont became president of General Motors after the retirement of W. C. Durant, he has confined himself more to a study of the industry, the company's units and possibilities of development than to the active direction of its forces. Practically a stranger to automotive manufacture, he has, for more than a year, been acquainting himself with the men in the industry and the factors that have brought it to its present strength. The realignment of Chevrolet is credited directly to duPont.

Knudsen, former production manager at the Ford Motor Co., was brought into General Motors two weeks ago as assistant to Vice-President C. S. Mott, chairman of the advisory staff of the company. In those two weeks he made a survey of several General Motors units, including the Tarrytown plant of Chevrolet and made certain recommendations. His appointment as operations head of Chevrolet came after these recommendations.

Bigger Production Likely

It has been no secret that Chevrolet has been unable to get into production on a scale that, coupled with present prices, would make the unit a profit producer. With Knudsen's experience in Ford manufacture, and it is said he is one of the few Ford men who ever resigned from that company, General Motors plans to gain the utmost efficiency in the production of its low priced car.

Since the duPont regime in General Motors began, the Chevrolet small car has been steadily built up mechanically to give the utmost value at the price. It is now a question of making the car, with its improved units, at a production rate that will justify prices. The company will concentrate all its efforts on the manufacture of the small line, the F. B.

K. T. Keller will remain as a vice-president of Chevrolet and manager of manufacturing, according to the duPont announcement, and Colin Campbell will continue as vice-president of the several sales companies and general sales manager of Chevrolet.

In connection with the changes, it is recalled at General Motors headquarters that Zimmerschied will be resuming work of a nature similar to that performed by him under Durant. The resignation of Durant from General Motors and Chevrolet resulted in Zimmerschied being elevated to the presidency of Chevrolet.

Business in Brief

NEW YORK, March 28—The Federal Reserve Bank of Atlanta has reduced the rediscount rate from 5 per cent to 4½ per cent because of materially improved conditions.

Crop conditions in the Middle West are decidedly better than a few weeks ago, and strengthening of rural purchasing power has begun to translate itself into orders.

Grain and livestock trade sentiment remains bullish. Ranchmen are planning to replenish their herds.

Freight traffic continues to expand, and there has been a further reduction in the number of idle freight cars.

Steel mill operations, which in some cases are at 65 per cent of capacity, reflect almost unprecedented building operations, which also have served to strengthen the lumber market.

Steel mill and furnace operations generally are expanding.

A feature of the cotton market is its continued strength in the face of bearish operations.

The hide market continues dull, although there has been an increase in footwear production.

Retail distribution of dry goods shows a seasonable quickening.

Bank clearings for the leading cities for the week ending March 23 were $6,817,817,000, a gain of 2.7 per cent over the previous week.

The trend of interest rates is steadily lower.

Investment demand for attractive securities, both new and old, continues strong.

April Will Surpass March in Business

This Month Has Improved Over February, Which Showed Parts Trade Doubled

By James Dalton

NEW YORK, March 28—March will show a decided improvement over February in the manufacture and sale of motor vehicles. Orders already booked by makers of parts and materials assure a better business for April than for this month. Beyond April the outlook is uncertain but there probably are few industries which can look as far ahead as May 1 with assurance of satisfactory sales.

A few parts plants are running at capacity and a substantial number of them are producing at 50 per cent of capacity or more. The total of sales by parts makers in February was approximately double that of January and aggregated the business done in March, 1921, which marked the renaissance of the industry after the slump.

Partly Due to Deflated Inventories

The better business which is being enjoyed by parts manufacturers is due in part to the deflated inventories of motor vehicle builders but not all of it, by any means, can be attributed to this cause. It demonstrates conclusively that both passenger cars and trucks are being sold in much greater volume than at the same time last year. Neither branch of the industry is building up a reserve of completed vehicles and all makers are holding their schedules approximately to actual retail sales.

Spring sales at retail, in substantial volume, have begun nearly two months earlier than they did last year. Speaking comparatively there may be a falling off after May, but a production total of passenger cars equal to 1921 is practically certain and the total of trucks will be substantially larger.

The tone in Detroit is immeasurably better than it was at this time last year and confidence has replaced uncertainty. This confidence is solidly founded and few manufacturers have extravagant hopes. They are studying their markets with the greatest care and making dealer allotments on this

(*Continued on page* 742)

Action Postponed Against National

No Hearing on Petition for Receivership Pending Move Toward Settlement

INDIANAPOLIS, March 27—Hearing on an application for the appointment of a receiver for the National Motor Car & Vehicle Corp., filed by the Columbia Axle Co. of Cleveland, has been postponed until April 1 at the request of attorneys representing the creditors' committee. The postponement was with the consent of lawyers for the axle company and was based on information that a settlement of the suit might be reached out of court.

Lack of Working Capital Claimed

The petition of the plaintiff alleged that the liabilities of the automobile company were in excess of $1,300,000 and that the company's business was suffering from a lack of working capital. The petitioners represent a claim of $12,305.

Company officials and officers of the Fletcher American National Bank, the vice-president of which, Oscar Welbon, is chairman of the creditors' committee which is operating the National factory, insisted at once that the suit had been brought through error. They also said that a representative of the Columbia Axle Co. had been in the city the day before the suit was filed and received a settlement that was satisfactory, and added that the suit would be dropped shortly. Elmer Stout, vice-president of the Fletcher American National Bank, who has been acting as an advisor of the creditors' committee, also affirmed that the suit would be dropped immediately.

Say Suit Was Misunderstanding

To-day George M. Dixson, president of the National company, and M. E. Elstun, secretary-treasurer, gave out the following statement: "The court action was brought through a misunderstanding and will be entirely eliminated by the plan now completed and to be carried out fully at once.

"The financial affairs of the National Motor Car & Vehicle Corp., according to the present agreement with all parties concerned, will be carried out as originally planned."

When the announcement of the refinancing of the concern was made some weeks ago, and the placing of a $750,000 mortgage on the plant was made known, it was stated that but part of the bonds that were to be issued would be floated at that time, and that additional working capital would be supplied in the future.

ERIE OFFICIALS INDICTED

ERIE, PA., March 27—The Federal Grand Jury has returned indictments against officials of the Erie Tire & Rubber Co. charging them with using the mails to defraud and conspiracy.

It is charged the concern had offices here and sold stock on the false claims that it had acquired a 60-acre factory site in this city and had started building a five-story plant. The company was incorporated in Delaware for $10,000,000, divided into 200,000 shares. The Government claims the company purchased no property and had not started a building. The company claimed it had a patent on a double-durability tire.

The officers indicted are: E. H. Blackstone, Robert T. Philip, Albert L. Sleeman, E. W. Snyder, Fred A. Deiberling, Emil Levy, Benjamin Leven and George M. Graham.

The Farmer Will Play a More Important Part in Progress of Industry This Year

By Walter P. Chrysler

Chairman of the Board of the Maxwell Motor Corp.

Detroit, March 23.

FARM buying will have an important part in the progress of the automobile industry in June, July, August and September. There has been considerable buying recently by the farmers, due to an increase in prices for some of their products, notably corn and hogs, and this business will grow as the demand for other of their products brings better prices.

Buying by the farmers after September will lessen, but it will greatly exceed their buying in the winter months of this year and last, when it was practically stopped.

Payment of a soldier bonus should not depress business inordinately if handled by the government on a sound basis. There should be no increase in taxes required. Those soldiers who were injured or are in need should be taken care of at once at all costs. Those who are not in need should be compensated as the business conditions of the country permit.

The more money there is for industry the more work there will be for everyone, and, consequently, more prosperity. Business has made steady gains in spite of resistance, owing to the withdrawal of money from circulation by the government to pay off debts incurred during the war. Prosperity is largely a matter of keeping money in circulation.

Sale of Obenberger Approved by Court

MILWAUKEE, March 27 — The sale of the assets of the defunct John Obenberger Forge Co., appraised at $955,342, for the equivalent of $233,000, to Adolph Weidner, Milwaukee attorney representing the secured creditors, has been approved by the bankruptcy court. The bid was made under the first call on March 10, but was held open by the referee with instructions to J. F. Gerdis, trustee, to seek other bids. Since none were forthcoming, the single original bid was ordered accepted.

The bid of Weidner involves only $48,000 in cash, but the purchasers agree to assume all secured claims, amounting to $185,000. The cash will be used as dividends to unsecured creditors, who will receive about 2 per cent, according to Gerdis. Unsecured claims total $500,880. Administrative expenses will come out of the $48,000, however.

The larger secured creditors in whose behalf the bid was made are the First Wisconsin National Bank of Milwaukee; Klug & Smith, Milwaukee contractors, and the Erie Foundry Co., Erie Pa. According to Weidner, the new owners expect to resume operations in about 30 days.

Form Steel Company with Wills Director

Capitalized at $15,000,000—Will Manufacture for Automobile and Allied Producers

DETROIT, March 27—C. Harold Wills, president of C. H. Wills & Co., is named as one of the board of directors of the new Dominion Alloy Steel Corp., Ltd., which will undertake the production of alloy steel in Canada with a plant at Sarnia, Ont., opposite Port Huron, Mich. The company will have an authorized capitalization of $15,000,000.

Plans thus far made public call for the production of 50,000 tons annually of alloy and high-carboned steels for automobile and allied manufacturers. The work will be financed by the sale of $3,500,000 8 per cent cumulative preferred stock, of which $2,500,000 is said to have been underwritten in Detroit and Cleveland, and $1,000,000 in Canada.

George A. Simpson, formerly sales manager of the Steel Co. of Canada, it is declared, will be vice-president and general manager. Other directors so far named are Harry R. Jones, Canton, president of the United Alloy Steel Corp.; J. J. Mahon, Newark; Sir William MacKenzie, Toronto; Bert H. McCreath, Toronto; Col. William McBain, Toronto; W. Wallace Johns, Toronto, and W. B. Boyd, Toronto.

BUS PLAN FATE IN DOUBT

NEW YORK, March 27.—Trial of a suit instituted by Edward Schafer, a taxpayer, to restrain the Board of Estimate of this city from appropriating $1,000,000 for buses, is expected to begin here to-morrow. If the city wins, it will have the right to spend as much money as it sees necessary, even to the extent of $30,000,000, which its bus plans call for.

Walker Refinanced; Banks to Aid Others

Cleveland Companies Needing It Will Be Provided With Additional Capital

CLEVELAND, March 26 — The refinancing of the H. J. Walker Co., maker of automobile engines, which has been announced here, is one of a number of contemplated steps to be taken by banking and financing interests of this city to provide additional capital for half a dozen Cleveland companies that are making automobile parts and accessories, according to well defined rumors.

With inventories worked down and other adjustments made, some of the companies find that the financial surgical operation was rather rough and that it left them lank and lean.

Banks in Better Position

The banks and financing interests here are said to be in a much better position than they were six months or a year ago, and they are now in a position to come to the relief of corporate interests that are intelligently managed and have a worthy product.

The plan for the refinancing of the Walker company, which supplies engines to the Grant Motor Car Corp. and others, was disclosed in letters that were mailed to stockholders.

It is known that a strong group has been formed for the refinancing and that when the names are announced they will give weight and prestige to the company. Until the plans are approved by the stockholders, the names of the syndicate managers and the new operating management will not be disclosed.

The Grant company will be greatly strengthened financially by the operation of the plan proposed, and it will help the corporation to push production and extend its sales campaign.

The notices that were sent to the stockholders propose that the $600,000 bond issue that is due in 1925 and which carries 8 per cent interest, should be exchanged for 10 year 7 per cent bonds that will fall due in 1932. This exchange would save the company 1 per cent in interest, and in the 10 years would amount to approximately $60,000.

$350,000 Floating Indebtedness

There is a floating indebtedness of $350,000, and this will be taken care of by a new issue of $350,000 of 7 per cent cumulative preferred from Jan. 1, 1923. This issue is to be taken at par by the creditors for their claims.

When the creditors do this, a syndicate of bankers and financiers that includes some of the best known men in this city will step in and provide the company working capital by purchasing common stock to the extent of $300,000.

Under such a plan as this, the company will have no obligation of a pressing nature, and its obligations will be limited to the funded debt, and with the capital provided it is felt it will have ample opportunity to develop its business.

It is stated that 50 per cent of creditors already have approved the plan, and that among this number are some of the larger ones. This makes operation of the plan probable.

Application to Appoint Templar Receiver Denied

COLUMBUS, March 27—Upon the grounds that the plaintiff, Nathan T. Clyburn, had not made a sufficient showing to the court to warrant such action, Judge Warner, in Common Pleas Court, refused to appoint a receiver for the Templar Motor Car Co. of Cleveland.

The court based its decision upon two grounds: first, that a creditors' committee is now in charge of the company and is performing the same service as a receiver, and second, that a syndicate committee has offered a plan of reorganization which has been adopted by the stockholders and that from this plan of operation a refinancing of the company seems evident.

Judge Warner also held that the company was not insolvent, as it had $1,387,000 assets as against liabilities of $1,131,000.

Court of Appeals Affirms Decision Against Livezey

NEW ORLEANS, March 27—William S. Livezey must serve a five-year sentence in Leavenworth Federal penitentiary for use of the mails to defraud in connection with raising the $3,000,000 capitalization of the Little Motor Kar Co. of Dallas of which he was president. The United States Circuit Court of Appeals here has affirmed the decision of the Federal Court at Dallas which convicted him.

Livezey was arrested April 13, 1920, after a receiver for the company had been appointed at Dallas on petition of stockholders who alleged that the company's affairs were being mismanaged. He was convicted in February, 1921.

United Auto Stores' Sale Postponed Until April 7

PHILADELPHIA, March 25 — Petition of the receivers of the United Auto Stores, Inc., for permission to sell the assets of the company resulted in the sale being held over until April 7 by Federal Judge Thompson.

Stockholders are given opportunity by this postponement to formulate a plan for reorganization, in the meantime. According to Samuel A. Whitaker and Francis F. Burch, the receivers, sale of the company's assets is imperative in order to put a stop to the payment of rentals on the 58 stores in the company's chain, none of which is earning money at this time.

Executives Further Plans for Zeder Car

Confer on Promotion of Company—Experimental Work on Product Not Completed

NEW YORK, March 27—Negotiations for the promotion of a company which will build, at the plant of the Cleveland Tractor Co., a new six-cylinder automobile selling at about $2,000 and to be designed by F. M. Zeder, approached completion at a series of conferences held here within the past few days. A complete announcement of the plans which have been worked out is expected in the near future.

Among those prominent in the conferences here were Clement Studebaker, Jr., Rollin H. White, president of the Cleveland Tractor Co.; R. T. Hodgkins, vice-president of the same company; Earl B. Wilson and Zeder, with several other engineers who have been associated with him for years. The identity of capitalists other than Studebaker and White who will have a share in the enterprise has not been disclosed.

After the preliminary negotiations have been completed it will be necessary to submit the entire proposal to the stockholders of the Cleveland Tractor Co., although this is expected to be largely a formality in view of the fact that acceptance of the plan will be recommended by the officers and directors. It has not been determined in just what way the present stockholders will be connected with the new enterprise.

Separate Plant for Car

It is probable the new car will be built by an entirely separate company in the Cletrac plant.

Experimental work on the Zeder car will not be completed for at least nine months. Designing work will be done at the Newark offices of the Zeder-Skelton-Breer Engineering Corp., but the experimental models will be built in the Cletrac factory.

Associated with Zeder in the development of the new car will be O. R. Skelton and Carl Breer, who went with him from the Studebaker Corp. when he was engaged by the Willys Corp. to design the Chrysler Six. When they severed their connections with the Willys Corp. they formed the engineering corporation to keep their organization intact. It is asserted positively by Zeder that the car which will bear his name will not in any sense be a copy of any developed heretofore, but will be an entirely new product worked out along scientific lines as the result of his own experience and that of his associates.

TRACTORS AND LITHUANIA

LONDON, March 14 (*by mail*)—The Lithuanian Minister of Agriculture considers that the wider introduction of tractors will result in the doubling of Lithuania's crop production.

40-Hour Week, New Ford Plant Policy.

Because of It Company Will Give Employment to 3,000 More Men

DETROIT, March 27—A forty-hour week of five days, with a shutdown Saturday and Sunday, hereafter will be the permanent working policy of the Ford Motor Co. and all other Ford interests. All employees will continue to receive the $6 a day minimum wage. Approximately 50,000 men will be affected and additional workers will be necessary under the new policy.

As soon as the new schedule can be put into effect at the Highland Park plant it will be extended to the other factories. In making the announcement, Edsel Ford said:

Every man needs more than one day a week for rest and recreation. The Ford company always has sought to promote ideal home life for its employees. We believe that in order to live properly every man should have more time to spend with his family.

Right now market demands warrant the operation of the plant six days weekly, but we are satisfied that the five-day week is practical and it has been adopted as a permanent policy of the company. Adjustments, naturally, are necessary. In equipment and in man power the plants will have to be placed on a basis where they can take care of production in five days weekly. It will mean work for 3,000 more men. It will mean more machinery. The goal cannot be fully realized at once. But as soon as possible it is the aim of the Ford company to adjust its business so that it can be carried on without work on Saturday and Sunday.

Demand for Trucks Increased

While Ford passenger car production now is considerably ahead of production at the same time last year, I believe the increased demand for trucks is a better indication of improvement in business conditions.

The demand for trucks has become more insistent each week. The truck is a business vehicle and increased demands must mean better business conditions.

Production at the plant of the Lincoln Motors Co. is now averaging from twenty to twenty-five a day. The market would warrant an output of sixty cars a day. Gradually the methods employed at other Ford plants are being installed, but it is doubtful if production ever will exceed fifty cars daily. Just this week a new aluminum casting plant for the Lincoln went into commission at River Rouge. Parts for the Lincoln will be cast at River Rouge and machined at the Lincoln factory, as is done with parts for other Ford vehicles.

The Ford company is co-operating with service organizations in seeing that deserving ex-service men receive first consideration in the matter of employment.

Will Include Lincoln Plant

DETROIT, March 27—The Ford five-day week will ultimately include the Lincoln Motors Co., but it will require considerable organizing to meet production demands before it can become effective. At present Lincoln is about 2000 cars behind on orders and will not catch up, working the full week and extra time in some departments, until well into the summer. A schedule of 700 has been fixed for April.

Privileges of the Ford investment plan now have been extended to Lincoln employees, thereby effecting a new bond between the new and old Ford enterprises. There is now $10,000,000 invested by 18,000 Ford employees under the investment plan. Interest and special returns of $1,250,000 have been paid to investors in the two years the plan has been in operation.

The Ford Motor Co. is working on a schedule of 67,000 cars and trucks for March. Foreign plant totals for February show Buenos Aires with 1245 cars and trucks; Manchester about 2000, and the Ford Motor Co. of Canada, 4000 cars and trucks. Bordeaux, Sao Paulo, Cadiz and Copenhagen were reported to have had good months.

BATTLESHIP AND FORD WILL OPERATE AS ONE

DETROIT, March 27—"If satisfactory arrangements can be made it may not be long before metal that was once a part of an American battleship will be running around in the form of a Ford car or tractor," says a statement by the Ford Motor Co. "The quality of the metal in war vessels will permit this.

"It can be remelted, carefully tested as to its suitability for mixing with other quantities of molten metal and poured into cylinder blocks and various castings. This ore that was mined, converted into metal and used in ship construction at great expense will not be an entire loss. Some, at least, of the taxpayers' money will be returned to the Treasury and, in addition, useful tractors built."

Transport Completes New Line of Trucks

MT. PLEASANT, MICH., March 27—The Transport Truck Co has a new line of trucks ready for distribution to dealers. There is a new Rapid Transport of 1-ton capacity for high speeds and heavier models, which differ from the previous line in capacity and are considerably lower in price. The following table shows the old and new models:

New Models		Old Models	
15, 1-ton	$1,295	20, 1-ton	$1,395
25, 1½-ton	1,495	30, 1½-ton	1,995
35, 2-ton	1,885	50, 2½-ton	2,785
55, 3-ton	2,385	70, 3½-ton	3,885
60, 3½-ton	2,585		
75, 5-ton	3,485		

The rear axle of the Model 15 is of bevel gear type. On the former line, all models had internal gear axles. The heavier models still retain this form of final drive.

No Ownership Change for American Dunlop

President Dissipates Rumor That Ford Will Buy—Production Prospects Indefinite

BUFFALO, March 27—The Dunlop Tire & Rubber Co.'s plant here will be operated as a Dunlop institution by the company which was formed for that purpose, Frederick Wolcott, president, declared upon the occasion of a visit to this city. Upon his arrival from New York he went into conference immediately with Perry D. Saylor, vice-president of the corporation.

"I am unable to say at this time when production will begin," Wolcott said. "We are working on plans which will lead to production, but it would be foolish for me to fix a date when we will begin producing tires in commercial quantities. The date will depend on a number of circumstances and conditions.

"It is my hope to be able to make a definite announcement within the next three or four months. I am very hopeful that this announcement will be very favorable to Buffalo.

"Sale of the plant to Henry Ford or any other person or corporation is not even being considered," Wolcott added. "Any rumors that the plant is to be sold are entirely without foundation. The factory will be operated as a Dunlop institution by the company which was formed for the purpose."

Puts End to Many Rumors

Wolcott's statement puts an end to many rumors which have been in almost constant circulation for many months. It has been repeatedly rumored that Henry Ford would take over the plant to produce tires for Ford cars. There have been numerous other rumors of sale of the plant, but heretofore there has been no official denial or confirmation of the reports.

The coming of Wolcott to Buffalo was rather unexpected. At 8 o'clock in the morning Saylor was not aware that he proposed coming. Wolcott arrived on an early train and went direct to the plant, where he planned to remain until after a conference had been held with the firm's attorneys.

Wolcott is in charge of all the Dunlop tire interests in the United States. The American branch of the British corporation is partly financed in this country, but is under control of the British Dunlop interests.

Production Never Undertaken

Commercial production of tires has never been undertaken at the River Road plant, although experimental manufacture has been in progress for many months. It is said the company is planning to specialize in a small size cord tire, when production begins, and that this tire will be sold at a price close to the present cost of fabric tires of the same size.

Reorganization Plan of Premier Delayed

In Meantime Suit Is Started by Bank to Collect Skelton's Insurance

INDIANAPOLIS, March 24—Reorganization plans of the Premier Motors Corp. which were scheduled to have been completed at a meeting of the reorganization committee March 21, have been delayed, and the official statement that was promised by a member of the reorganization committee for Wednesday has not yet been made.

On that day at Martinsville, Ind., a suit was brought by the Fletcher American Bank of Indianapolis against the Travelers Insurance Co., the American Life Insurance Co. and the Premier Motors Corp., to collect a policy for $200,000. The policy was taken out by the late L. Sherman Skelton, former Premier president, and was transferred by him to the motor corporation which in turn transferred it to the Fletcher American Bank. The insurance companies are fighting payment because they assert Skelton withheld certain facts concerning his health at the time he took out the policy.

Same Bank in Charge

It was understood that the bank that was expected to handle the details of the proposed reorganization is the same one that is suing the insurance companies and the Premier corporation. M. A. Whipple, vice-president of Premier, the spokesman for the reorganization committee, stated early this week that the reorganization was practically complete, that mere details were still pending, that 75 per cent of the merchandising creditors had agreed to the plans, that three or four new directors were to be named, and that about $500,000 of new money would be supplied for working capital.

All these things were to have been finally set by the meeting proposed for last Tuesday, and an official announcement was promised by Wednesday. Since then no further details could be obtained, except with reference to the suit referred to above and intimations that the statement, when made, would be announced by the banking institution handling the deal. The management after the reorganization, according to Whipple, had not been agreed upon by Wednesday afternoon.

Marlin-Rockwell Tax Dispute Is Adjusted

NEW YORK, March 28—The following statement has been issued by the Marlin-Rockwell Corp.:

"The tax dispute of the Marlin-Rockwell Corp. with the Government has been adjusted and the tax paid," according to H. C. Pryer, treasurer. "The corporation officers and directors state that the attitude of the treasury department has been fair and reasonable."

It states further:

The future policy of the corporation will be to confine itself to the ball bearing business which it operates under the Standard Steel & Bearing, Inc., of which it owns all the stock, and the liquidation of those assets which are unnecessary to this industry.

The management states that the bearing manufacturing facilities of this corporation are the largest of any of the companies engaged in this business except the General Motors, and the newest and most modern.

The corporation's present business reflects the general revival in activity in the automotive industry which it serves. Guy W. Vaughan, president and general manager of the Standard Steel & Bearing, Inc., has been elected vice-president of the Marlin-Rockwell Corp.

The Government's original claim is understood to have been in the neighborhood of $8,000,000.

Special Delivery Car Brought Out By Buick

FLINT, MICH., March 29 — Buick Motor Co. has brought out a special delivery car on a 4-cylinder chassis, with three types of bodies. The open express is priced at $945; the canopy top delivery with roll curtains, $965; canopy top delivery with screen sides, $1,015; panel side delivery with steel panels, $980 and panel side delivery with vehisote panels, $1,005.

The bodies are especially designed for strength and rigidity achieved by the extra strong bracing and steel binding of panels, flare boards and tail gate. An additional re-inforcement is assured by heavy steel angles running the entire length of the body along each side to form a side frame. The rear end is entirely sill-bound and scuff strips extend well into the body and bend over to join the reinforcement construction.

The vestibule has steel sash drop windows, which are cushioned to prevent rattling. The doors may be secured back for summer driving. The engine, starter, clutch and other units are identical with the four cylinder passenger car chassis.

Purchaser of Quality Tire to Resume April 1

ANDERSON, IND., March 27—The International Rubber Co. of America, incorporated in Delaware, whose bid of $200,000 for the Anderson plant of the Quality Tire & Rubber Co. has been accepted, is making preparations to operate the factory here probably by April 1. J. D. Wiggins, president and general manager, formerly was connected with the American Can Co. M. D. Ganger of Cleveland will be vice-president and general manager. They will move here at once. A. L. McKee, secretary and treasurer, also of Cleveland, will come here later.

The sale of a factory at Elyria, Ohio, which also was owned by the Quality company, has been agreed to at Elyria but the deal will not be closed until an Ohio form of transfer is submitted, according to Neal M. McCulough, local banker and trustee for creditors.

Star Will Be Built in All Durant Plants

Expansion of Long Island City and Lansing Factories to Be Undertaken

NEW YORK, March 28—Announcement is made by Durant Motors, Inc., that the new Star car will be built in all its divisional plants. This includes factories at Long Island City, Lansing, Muncie, Oakland, Cal., and Toronto.

The Long Island City and Lansing plants will be expanded to provide a production of 20,000 cars a month by Jan. 1 next, including the Star and the Durant Four. The expansion of the Lansing factory will be undertaken immediately. The same will be true at Long Island City, provided the land required can be obtained at what is considered a reasonable price. The engineers and contractors who built the Lansing factory now are in this city looking into the situation.

Reports that Durant Motors have acquired from the receivers of the Willys Corp. the huge factory at Elizabeth, N. J., which never was occupied, are at least premature. Durant engineers have inspected the property carefully, however, and it is understood they have reported it would meet the needs of the company. It is not likely that Durant will acquire the Elizabeth factory unless it can be obtained at a fraction of its original cost of $10,000,000.

Production of the Star and the Durant will be completely segregated, although it is desirable from a manufacturing point of view that they be built as near together as possible in view of the fact that materials will come from practically the same sources.

Durant Motors also announces that it has placed with the Continental Motors Corp. of Detroit an order for 250,000 motors for use in the Star. This is one of the largest, if not the largest, single order for motors ever placed.

Quantity Output at Lansing

LANSING, MICH., March 27 — The Durant Motor Car Co. of Michigan now has launched into actual quantity production. Arrangements have been made by M. B. Leahy, the Durant general sales manager, for trainload shipments to Kansas City and Cincinnati.

The train to Kansas City will be made up of thirty-six freight cars, carrying a total of 180 4-cylinder Durant phaetons, to the Hathway Motor Co. The shipment to St. Louis will be made up of twenty-five freight cars and will total 125 phaetons.

MOTOR FUEL FROM WINE

LONDON, March 18 (*by mail*)—The stagnation in the South African wine industry has led to the establishment of a plant at Paarl for the purpose of converting wine into a gasoline substitute. Last year 10,000,000 gallons of unsaleable wine were produced in the Union.

Truck Tire Business Gaining, Akron Says

Is Taken, in Conjunction with Survey, as Indication of General Improvement

AKRON, March 27—That a widespread general increase in the prosperity conditions of the United States is apparent with strong indications of a continued upward trend in all lines of business, is the opinion of Akron tire manufacturers, based upon surveys being made in all sections of the country in connection with district conferences with sales representatives and branch managers.

"Skepticism is abating. Business is picking up encouragingly. We face a big period of prosperity and production along all lines will have to be increased," states W. A. Johnson, tire sales manager of the B. F. Goodrich Co.

Optimism Soundly Based

"The kind of prosperity that is founded neither on guess nor upon the unjustified hopes of optimists, is returning to the country at a steadily increasing rate," says L. G. Fairbank, general sales manager of the Firestone Tire & Rubber Co.

Johnson also says regarding the situation:

One of the best proofs of a return of conditions more nearly normal is the fact that bankers everywhere are advancing money. Tire dealers are paying their bills and are stocking up in anticipation of a heavy trade this spring and summer. Tires are moving much more rapidly than for months. There were over 220,000 passenger cars and trucks built the first two months of this year. This was an increase of 200 per cent over the same output for the corresponding months of 1921, and meant 880,000 tires as original equipment, and another 220,000 truck and motor car tires to go along with such new vehicles as spare equipment.

The downgrade movement has stopped. Automobile sales are speeding up and this increase has its direct reflection in Akron.

Manufacturers here say the truck tire sales constitute a good barometer of general business conditions. They report truck tire sales increasing heavily and accept this as proof that commercial houses employing trucks are again using them extensively and that such renewed truck use in turn reflects a healthier condition in business.

Price Changes Considered

There is still talk of approaching tire price increases. Some dealers, expecting future requirements, are stocking up now so as to be in position to take advantage of the increases in prices when they come. Manufacturers agree that from the standpoint of making money for their stockholders, prices should be increased. It is also admitted that the price slashing war carried on vigorously by competitive tire companies last year, was carried a trifle too far and that the last of the series of price cuts made, which was enforced last December, was excessive.

Move on Upgrade

NEW YORK, March 27—Sales by Mack Trucks, Inc., are running well ahead of last year at this time. If business continues at the current rate, substantial profits are expected for the second and third quarters.

NEW YORK, March 27—H. Alpern, export manager of the King Motor Car Co., reports that foreign sales for February were the largest for any month in the last five years. Agencies have been established in five additional countries. Twenty cars recently were shipped to the dealer in Switzerland.

KENOSHA, WIS., March 27—The Nash Motors Co. reports that shipments for March will exceed the same month last year by approximately 67 per cent. Factory records show that 2081 Nash cars were ordered by dealers and distributors in March last year, while this year's orders for March shipment totaled 3486. These figures include both four and six-cylinder models.

AKRON, OHIO, March 27—The General Tire & Rubber Co. reports that sales for the first quarter of this year have been 65 per cent larger in dollars than for the same period in 1921. In units the sales increase has been 100 per cent. All tires manufactured are sold through dealers to users.

DETROIT, March 23—Chevrolet Motor Co. has started a night shift at the Flint plant for the first time in several months. Nine hundred axles a day are now being made for shipments to the various assembly plants. It is planned to build 800 engines a day by April 1. All engines and axles for Chevrolet cars are now being made at Flint.

DETROIT, March 27 — The Fisher Body Corp. reports that it has been compelled to refuse several new orders because of a shortage of manufacturing facilities. Some of the Detroit plants are working overtime while others are not yet at capacity. The average for the Fisher factory is about 95 per cent of capacity.

L. G. Fairbank of the Firestone company does not predict a business boom nor a return of the superficial prosperity of 1920, but says he believes the United States is on the eve of a broad, substantial increase in business that will mean much to every one by reason of the fact that it is founded upon hard work and the creation of new economic values, and not on fictitious and speculative gains in the value of stocks, etc.

Renewal of Demand Felt in Truck Lines

Call Reported to Be for Lighter Types, Principally for ¾-Ton Capacity

MILWAUKEE, March 27—Encouragement is found daily in reports from manufacturers of passenger cars and the parts industry as well, which indicate that the improvement which set in 30 to 40 days ago is going forward. A little better feeling also has been injected into the motor truck industry by something akin to a renewal of demand, although this is yet far from satisfactory. So far the principal call has been for the lighter types, with sales of the ¾-ton capacity predominating.

Tractor Prospects Better

The manufacture of tractors has not yet been resumed on anything like a real scale, but prospects are growing better as the surplus stocks in hands of makers and jobbers are steadily being wiped out by the much better movement of these machines into farmers' hands. This is being accomplished, of course, through drastic price reductions which are far below immediate replacement value, but opinion seems to be that current reductions probably will hold effect until May 1 or June 1, when production doubtless will have been resumed on a scale sufficient to enable producers to gage true costs on the readjusted basis.

Authentic reports from representative Milwaukee industries indicate that the iron, steel and machinery trade is moving steadily into a stronger position.

Conditions Everywhere Improved, Wollering Says

NEW ORLEANS, March 29—"Conditions the country over, North, South, East and West, are showing improvement, gradually but decidedly," declared Max F. Wollering, vice-president in charge of manufacturing, of the Studebaker Corp., during his visit here as the guest of Fred Perkins, local Studebaker distributor.

Wollering asserted that the country was on the eve of a period of prosperity, and that manufacturers and dealers who exercise the initiative to establish their business on a sound basis will reap big benefits.

HIGHWAY BODY TO MEET

NEW YORK, March 27—Reports of various committees which have been studying different phases of highway transport will be heard at the annual meeting of the National Highway Traffic Association, which will be held at the Automobile Club of America in this city, May 12. The reports will cover regulations relating to speeds, weights and dimensions of motor trucks and trailers; license fees and motor vehicle taxation; and highway transport franchises.

International Trade Improves Materially

Total Shipments 3550 in February Are Almost Equal to Same Month, 1921

NEW YORK, March 27—Overseas shipment of approximately 1350 passenger cars were made during the month of February by the General Motors Export Co. from its plant in Canada. Of this number, a total of 824 were shipped to all parts of the world except to England, to which was shipped between 500 and 600 more, the exact figures for the English shipments not being available here. The totals were announced here to-day by the export company, following the receipt from Washington of the figures for the February shipments from the United States.

The Washington announcement does not include, of course, these Canadian shipments which, added to the total of 3096 announced for the United States, show that the short month of February saw the overseas movement of approximately 4500 automobiles. No month's export sales since January, 1921, have even approached this high figure.

WASHINGTON, March 25—The belief that international trade in automobiles and automotive equipment had improved materially was amply borne out by the February shipments from the United States, the figures for which were announced to-day by the Bureau of Foreign and Domestic Commerce through the automotive division. Striking gains were shown over January, 1922, and for the first time in many months the shipments of automobiles were comparable with those of the same period of the previous year.

The February trade in passenger cars totaled 3096 and trucks 454, a total of automotive vehicles of 3550. The same month in 1921, when the last dispatch was being made on the unfilled orders piled up during the boom years of 1919 and 1920, saw the outbound movement of 3587 automobiles, of which 2492 were passenger cars and 1095 were trucks. The trade by volume in February in this year, therefore, was the largest since January and February of 1921 and almost double that of some of the low months during the latter part of last year. A comparison follows:

Passenger Cars

	No.	Value
Feb., 1922	3,096	$2,556,555
Jan., 1922	2,407	2,025,974
Feb., 1921	2,492	3,165,170

Motor Trucks

	No.	Value
Feb., 1922	454	$391,738
Jan., 1922	464	461,193
Feb., 1921	1,095	1,952,736

Parts

	Value
Feb., 1922	$2,838,259
Jan., 1922	2,060,619
Feb., 1921	3,426,517

Thus it is shown that the foreign sales of American automotive equipment are again approaching appreciable levels and that overseas trade is stabilizing itself

(*Continued on page 742*)

Exports, Imports and Reimports to Automotive Products for February, 1921 and 1922, and for Eight Months That Preceded

	Month of February				Eight Months Ending February			
	1921		1922		1921		1922	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobiles, including chassis	3,587	$5,117,906	3,560	$2.962.135	90,998	$119,972,935	22,892	$20.506,229
Electric trucks and passenger cars	....	.....	10	13,842	....	.....	36	54,967
Motor trucks and buses, except electric	1,095	1,952,736	....	.....	15,499	26,496,400	2,727	2.851,223
Up to 1 ton	....	.....	286	117,187	....	.....	508	231,254
Over 1 and up to 2½ ton	....	.....	141	210,264	....	.....	361	497,735
Over 2½ ton	.....	.....	27	66,347	....	.....	49	123,942
Total motor trucks and buses, except electric	1,095	1,952,736	454	391,738	15,499	26,496,400	3,645	3,704,154
PASSENGER CARS								
Passenger cars, except electric	2,492	3,165,170	....	.....	75,499	93,476,535	13,708	12,164,579
Value up to $800	....	.....	1,890	958,814	....	.....	3,220	1,649,879
Value over $800 and up to $2,000	....	.....	1,096	1,217,578	....	.....	2,090	2,273,457
Total passenger cars, except electric	2,492	3,165,170	3,096	2,556,555	75,499	93,476,535	19,211	16,747,108
PARTS, ETC.								
		Pounds						
Parts, except engines and tires	....	3,426,517	*12,138.682	2,838,259	....	55,699,086	....	19.141,425
Station and warehouse motor trucks	23	14,514	6	11,137	431	248,286	75	87,886
Trailers	....	.....	26	19,230	....	.....	59	40,233
Airplanes	....	.....	....	.....	53	386,955	19	126,165
Parts of airplanes, except engines and tires	....	24,213	*22,758	10,146	....	.....	....	68,104
BICYCLES, ETC.								
Bicycles and tricycles	....	199,705	237	4,783	....	3,106,761	....	429,502
Motorcycles	1,000	333,437	969	259,347	21,870	6,862,488	5,023	1,386,762
Parts, except tires	....	.....	*209,921	108,971	....	.....	*439,839	240,648
Gas engines	123	39,774	222	16,673	2,630	500,116	1,021	183.801
Traction engines, except agricultural	4	6,244	2	4,813	254	446,855	12	32,045
Automobile engines	881	153,258	2,764	331,479	9,888	1,794,304	8,181	1,283,548
Aircraft engines	....	.....	1	200	....	.....	4	5,475
Complete tractors, except agricultural	1,453	1,577,979	6	32,201	18,889	18,662,999	141	237,919
Other internal combustion engines	1,157	281,592	335	39,395	11,723	1,862,592	3,096	399,653
IMPORTS								
Accessories, parts	....	.....	279,708	164,797	....	.....	940.144	387,006
Automobiles	59	76,181	26	44,960	919	981,274	339	530,003
Parts, except tires	.....	81,663	....	58,495	....	941,790	....	405,274
All other	....	11,192	....	7,202	....	392,123	....	194,630
REIMPORTS								
Automobiles (free of duty)	23	27,720	200	294,357	2,155	3,251,608	2,289	3,482,359

*Pounds.

SHORTAGE OF SKILLED WORKMEN

DETROIT, March 25—Shortage of men for skilled positions is taken by the Employers' Association of Detroit as an indication of a return to normal in general business. There is unemployment, the report declares, but mostly of men of no special training. For the week 79 firms report 3273 men employed.

Gray Phaeton, $490; $760, Coach Price

Company Has Completed Its Financing and Withdrawn Stock from Sale

DETROIT, March 28—Gray Motor Corp. has fixed the prices on its phaeton and coach at $490 and $760 respectively and will get into quantity production on its schedule for 1922 in May. In connection with the fixing of the prices, it was announced that the car will be powered with a 4-cylinder Gray engine and will have Timken axles front and rear.

D. Henry Bonner has been named sales manager of the company. Bonner was formerly in charge of all branch production for the Ford Motor Co. and served latterly as assistant production manager to William S. Knudsen.

President Frank L. Klingensmith, formerly Ford executive vice-president and treasurer, said the company has completed its financing and has withdrawn its stock from sale. The company is capitalized at $4,000,000 and has sold $2,600,000 in stock, assuring ample financial strength.

Production in Detroit

All production and assembly of the car for the present will be at the Gray plant in this city. There is a present capacity for 250 engines and 100 cars daily which will be increased in anticipation of 1923 business. Assembly plants in the New York, Boston, Philadelphia and St. Louis districts are expected to be opened before December with others to follow in 1923.

As designed for production, the car will weigh about 1600 lbs. and will have a wheelbase of 100 in. Artillery wood wheels have been substituted for disk as more becoming the lines of the car. Under test the car has travelled 20 miles to the gallon of gasoline and 25 miles per gallon has been fixed as normal expectancy.

The coach type closed car has been selected as most economical to manufacture on a quantity basis. In both open and closed models the body lines have been kept low. The open model has a one-man top. The gearset will be Gray made three speeds forward and reverse. With the exception of body, wheels and axles, the car will be practically a Gray manufactured product.

Material Contracts Placed

Contracts for all material for the complete years production have been placed.

Among the dealers thus far named by the company are: Albert Hirst, New York; Brown Motors Co., Boston; Louis C. Block, Philadelphia; Anderson Strauss Co., St. Louis; Charles E. Baker, Detroit; John S. Keown, Louisville and Edward P. Wilson, Columbia, S. C.

All applications for foreign sales rights have been deferred pending the meeting of domestic sales demands.

FORD CUT IN BRITAIN HAS NO U. S. BEARING

LONDON, March 20 (By mail).—Price reductions ranging from £10 to £15 (normally from $50 to $75) on the various Ford models have been announced here. The biggest cut is on the sedan.

DETROIT, March 28—The Ford Motor Co. said to-day that the reduction of prices in England had no significance so far as the United States is concerned. It was asserted that the drop was based on the January reduction here, which was only $5 on the phaeton.

Organization of a company personnel will be held to a minimum with Klingensmith in charge of all financial matters, F. F. Beall, former Packard vice-president, in charge of manufacturing and Bonner in charge of sales.

Maxwell Will Build 250 Daily in April

DETROIT, March 25 — Walter P. Chrysler, former executive vice-president of Willys-Overland Co., will devote all his efforts in the automobile field to his work as chairman of the board of the Maxwell Motor Corp.

"We are going to make 250 Maxwells a day in April to meet the steadily growing demand for our product," he said. "Sales are extending all the time as the value of the new lines becomes known. We have now got our organization developed to a point where every detail is properly cared for and, after a year of hard work, we are getting the results hoped for."

Chalmers business in April will show a large increase over former months despite increased price, Chrysler said. There has been considerable business in March due to orders being placed to get in before the increase, he said, but April business already placed will show an increase over March business.

Merchandising plans are being developed whereby the factory will be enabled to co-operate completely with the sales organization in the field in developing Maxwell business. Under this plan, service will be a leading factor and genuine parts will be constantly available to all owners.

TO SELL HARTFORD PARTS

HARTFORD, CONN., March 29—Because of the failure of stockholders and creditors to come to terms on plans for a reorganization, Federal Judge Thomas has ordered the sale at public auction on May 3 of all assets of the Hartford Automotive Parts Co. The upset price has been fixed at $325,000, not including a mortgage of $75,000.

Jordan Cut Restores Pre-War Price Level

Reduction Affects All Models But One—Company Plans 1,000 Output for April

CLEVELAND, March 29—Price reductions on the different Jordan models announced by the Jordan Motor Car Co. range from $300 to $400. This reduction brings prices back to the pre-war level. Owing to increased production and improvements the cars as produced to-day can scarcely be compared with those of pre-war days, excepting in the matter of price.

The new prices are:

	Old Price	New Price
5-passenger	$2,095	$1,795
Playboy Roadster	2,095	1,895
5-passenger Sedan	3,200	2,785
Brougham	3,200	2,785
Landaulet	2,995	2,695

The Playboy roadster is standard equipment with disk wheels, wire wheels being optional; special colors, and nickel lamps furnished. The price of the seven-passenger Jordan models has not been reduced.

Jordan production will approximate 800 this month and the schedule for April is 1000.

TWIN CITY MODEL REDUCED

MINNEAPOLIS, March 24—Minneapolis Steel & Machinery Co. announces a reduction in the price of its Model 12-20 Twin City tractor from $1,395 to $1,200.

O'BANNON REORGANIZED

NEW YORK, March 29—The O'Bannon Corp., manufacturer of coated fabrics, which has been operating under a receivership for several months, has been reorganized as the O'Bannon Co. The personnel of the operating departments will remain largely the same, but the company will be under the management of the Russell Co. of Boston.

ASKS OWEN REPAYMENT

WILMINGTON, DEL., March 27—Application has been made by the Wyoming National Bank of Wilkes-Barre, Pa., for repayment by the receivers of the Owen Magnetic Motor Car Corp. of expenses it incurred in having the first sale of the personal property set aside. The amount sought is $2,960.

MEXICAN CHAMBER FORMED

NEW YORK, March 27—The Mexican Chamber of Commerce of the United States has been incorporated in New York State with the approval of the State Department in Washington. Its object will be to promote business and economic relations between Mexico and the United States by the dissemination of information of mutual interest.

Men of the Industry and What They Are Doing

Mosher Remains as Director

F. E. Mosher, whose resignation as vice-president and treasurer of the Covert Gear Co., Inc., was announced last week, will continue as a director of that company until the annual meeting in August. Mosher, who went with the Covert Gear Co. in 1916 as secretary and general manager, will become assistant to the president and general manager of the Dosch Chemical Co., Inc., of Louisville on April 3. He was made secretary and treasurer of the Covert company in 1919 and the following year was elected to the position which he now is relinquishing.

Hornby with Rickenbacker

Fred Hornby has been appointed superintendent of the final assembling division of the Rickenbacker Motor Co. He was engaged in similar work with the old E. M. F. Co., later joining the forces of the Maxwell Motor Co. in an executive production capacity and subsequently becoming research engineer for the Willys-Overland Co.

Willis Made H. C. S. Sales Manager

Frank B. Willis, who has been prominently identified with automobile factory sales organizations of Michigan and Ohio, his connection at one time being with the Chalmers Motor Corp. as vice-president and with the Saxon Motor Car Corp., has returned to Indianapolis to become general sales manager of the H. C. S. Motor Car Co. Harry Ford, whom he succeeds, is still with the sales organization, and will devote most of his time on the road and in field work.

Elgin Motors Appoints Leach

K. J. Leach, for three years connected with the McFarlan Motor Co. as southwestern district manager and previous to that association engaged in the same work for the Cole organization, has been appointed district representative for the Elgin Motor Car Corp. His territory includes Texas and New Mexico, with headquarters at Dallas.

New Battery Sales Head

W. Melville Taylor, until recently connected with the Philadelphia Storage Battery Co. of Philadelphia, has been appointed to the managership of eastern sales of the Foster, Merriam & Co., Meriden, Conn. E. W. Shepherd, who has been associated with the sales promotion department, is manager of western sales for the company.

Webb Promoting Hinkley Sales

Paul St. Elmo Webb has been added to the organization of Hinkley Motors, Inc., Detroit, as sales promotion manager. Webb's experience has covered a broad range of service in the field of heavy duty transportation, both as an executive of sales and service and as a transportation engineer with the Diamond T. Truck Co. of Nashville. In his new position, Webb will pay close attention to the application of trucks and buses equipped with Hinkley engines to the various problems continually arising. He will also work in close touch with dealers and distributors of vehicles so equipped who may desire data, information and advice.

Haggott Becomes Field Engineer

William S. Haggott, for several years cable sales manager of the Packard Electric Co., Warren, Ohio, has been transferred from the home office to the field organization of the company in the capacity of field engineer. His headquarters will be in Detroit. Haggott has been prominent in the work of the Society of Automotive Engineers and the Automotive Equipment Association. He is at present chairman of the S. A. E. subcommittee on standardization of automotive cables and represents the society on the cable committee of the American Engineering Standards Committee. The work Haggott leaves at the home office will be absorbed by W. F. Parker, general sales manager, and B. N. MacGregor.

Witherbee, Marko Sales Head

Thomas S. Witherbee has been named general sales manager and director of advertising of the Marko Storage Battery Co. He is a pioneer manufacturer of storage batteries for automobile starting, lighting and ignition. Witherbee has been in the battery business since 1897 and is the inventor and patentee of the Witherbee storage battery igniter, which was produced and sold by the Witherbee Igniter Co., founded by him.

Maloney Joins Parish & Bingham

John E. Maloney, widely known in equipment trade circles, has joined the Parish & Bingham Corp. as assistant sales manager. In assuming his new connection Maloney severs a connection of some ten years with the Hydraulic Pressed Steel Co. and its interests, during the latter part of which he was general manager of the pressed steel end of the business.

Clark Back from Trip

W. W. Clark, export manager of the Hart-Parr Co., has returned from a four months' trip to the Philippine Islands, Australia and intermediate points in the interests of the company.

Swanson Leaves Fox

H. O. Swanson has resigned as chief engineer of the Fox Motor Car Co. of Philadelphia.

Reeves Tours Plants; Surprised at Output

Convinced Production Will Exceed 1921 Greatly—Finds New Spirit Prevailing

NEW YORK, March 29—Genuine surprise at the current volume of production, both of passenger cars and trucks, was expressed by Alfred Reeves, general manager of the National Automobile Chamber of Commerce, upon his return from a two-weeks' trip through the factories in Michigan and Ohio.

While Reeves has been consistently conservative in his estimates of passenger car production for 1922, and believed until he started on his trip that it would not greatly exceed that of 1921, he now is convinced that the total will be considerably larger. He feels no doubt that that truck production will be materially increased.

Conservatism Shown

Concerning conditions, Reeves says:

Everywhere I traveled I found a new spirit among the manufacturers and dealers. Production was increasing; dealers were writing in for cars; some factories were duplicating some of the 1920 figures by trainload shipments to the coast and elsewhere; more than 3,300 additional men were added to the payrolls in Detroit in one week and in some cities there was an actual shortage of experienced automobile workers, although still a large surplus of unskilled labor.

Notwithstanding all this, the makers are going along with a spirit of conservatism and with no idea that the spring business will continue for the remainder of the year, although with every indication that the last six months would be better than the same period of 1921.

The big keynote for this year is going to be the dealer and that manufacturer will succeed best who spends money to back his dealer into better financing, selling and general business methods.

Any plan the manufacturer contemplates should be predicted entirely on whether it is going to be best for his dealers. I don't believe we will ever have an opportunity again to build up dealers as we have during the past and each one lost now will cost a great deal of money to replace.

RECEIVER FOR HALLADAY

NEWARK, OHIO, March 29—A receiver has been appointed for the Halladay Motors Corp., which is capitalized at $400,000. The proceedings were instituted by the Barber Asphalt Paving Co. of Pennsylvania. The motors company admitted its obligations and joined in the petition for the appointment of a receiver. Edward Kible, an attorney, was appointed, and his bond was fixed at $30,000. The Halladay company came here three years ago from Attica, Ohio, and was heavily financed by Newark residents.

Goodyear Tire Shows Profit of $9,640,235

Ratio of Current Assets to Current Liabilities Is More Than Ten to One

AKRON, March 27—For the first ten months of operation of the Goodyear Tire & Rubber Co. of Akron under the financing control which succeeded the Seiberling régime under the company's reorganization and $85,000,000 refinancing program, sales totaled $82,195,550, while a net profit of $9,640,235 is reported, according to the annual Goodyear statement made public to-day by President E. G. Wilmer. The report is for the ten-month period ending Jan. 1, 1922.

The $82,195,550 in sales are exclusive of all subsidiary companies and compare with sales of nearly $205,000,000 in 1920 for Goodyear under the presidency of Frank A. Seiberling, founder of the company. During the last year of the Seiberling régime, however, due to heavy losses on commitments, a deficit of $15,647,653 was reported.

Net Balance of $3,620,043

After deduction of interest and fixed charges, including miscellaneous adjustments in respect of investments in subsidiary companies, there remained out of the net profit of $9,640,235 a total net balance to surplus of $3,620,043, according to President Wilmer's report. Cash and the United States Treasury certificates are listed at $23,892,820. Although current liabilities included accrued interest and premium on bonds amounting to $1,371,574, the ratio of current assets to current liabilities is more than ten to one, Wilmer announces.

The adjustment in respect to investments in subsidiary companies, aggregating $1,508,820, in a large part reflects additional write-downs of inventories in both domestic and foreign subsidiary companies to a basis dictated by current market values, as well as substantial losses in the export business due to depressed exchange.

The Goodyear Tire & Rubber Co. of California and the Goodyear Tire & Rubber Co. of Canada, Limited, the company's principal operating subsidiaries, continue to show satisfactory current earnings, and the company's export business has been restored to a profitable basis, Wilmer reports. Neither the parent company nor any of its subsidiaries to-day has any bank indebtedness.

Officers Re-elected

All officers are re-elected, while three new directors are added. These are Francis Seiberling, Akron attorney, cousin of F. A. Seiberling and legal counsel for Goodyear under the Seiberling régime; Russell L. Robinson of the Robinson Clay Products Co. of Akron, and H. H. Springford, assistant to the president.

Old directors re-elected include Roger Hyatt, Paul W. Litchfield, G. M. Stadleman, Grayson M. P. Murphy, Robert Schaffner, Armin A. Schlesinger, A. H. Scoville, G. P. Steele, and Ralph Van Vechten. Stadleman and Litchfield are vice-presidents, having served in similar capacities under Seiberling and being the only old Seiberling executive officers to remain under the Goodyear reorganization. Litchfield is factory manager.

Executive officers are E. G. Wilmer, president; G. M. Stadleman and P. W. Litchfield, vice-presidents; H. H. Springford assistant to the president; P. H. Hart, treasurer; P. R. H. Leroy, assistant treasurer; C. A. Stillman, secretary; W. D. Shiltz and C. F. Stone, assistant secretaries; C. H. Brooks, comptroller, and C. L. Weberg, H. D. Hoskin and A. F. Eggleston, assistant comptrollers.

California Subsidiary Report

AKRON, March 25.—The Goodyear Tire & Rubber Co., of California, a subsidiary of the Goodyear Tire & Rubber Co. of Akron, which started operations at Los Angeles in July, 1920, as the first major tire factory on the Pacific Coast, in the ten-month period ending Dec. 31, 1921, reduced its net deficit from $3,157,762 to $1,672,453 by applying thereon the company's net earnings for the same period, which totaled $1,485,309, according to the annual report of the California company.

The western company, President E. G. Wilmer states, is in a strong position financially, at present the ratio of current assets to liabilities being approximately 13 to 1. The company lists current assets of $7,045,952 and current liabilities of only $538,935. The company has wiped out its bank indebtedness and announces that all trade accounts payable are being currently discounted.

Total net sales for the California company for 1921 were $14,333,500, compared with $16,128,850.

This Will Be Better Year Than 1921, Bank Asserts

MILWAUKEE, March 27—"This will probably be a somewhat better year in the automotive industries than last year," is a significant statement in the current issue of *Business and Financial Comment*, monthly business review issued by the First National, the largest bank in this city. It goes on to say:

Because agricultural prospects are looking up, the demand for tractors and farm implements bids fair to improve. The leading makers of farm machinery have made drastic reductions in prices in order to get down to the level of farm purchasing power, although severe competition among manufacturers also is partly responsible.

Assuming that a tractor lasts on the average six years, the replacement demand in the present year would not be much over 10 per cent of possible manufacturing capacity, figuring that in 1920 a total of 200,000 tractors were produced. The tractor manufacturing business, therefore, is dependent to a very large extent upon the development of new demand. In the motor car business, by contract, replacement demand has come to be a much more important factor.

M.A.M.A. Group Plan Will Be Abandoned

Directors Base Action on Policy and Expediency—Long Released from Duties

NEW YORK, March 28—Directors of the Motor and Accessory Manufacturers Association have decided, on the ground of policy and expediency, to abandon the group plan of organization for manufacturers making products of the same general character. Notices have been sent to members informing them of the action taken.

Considerable progress has been made in developing this form of organization and associations whose members produced springs, sheet metal, wood wheels and headlights had been taken into the M. A. M. A. as groups. The latest to affiliate were the makers of headlights, who acted during the Chicago show, and the Automotive Wood Wheel Manufacturers Association, which voted during the New York show to dissolve its organization.

Long Was Named Manager

After the wheel makers came in, Hargrave A. Long of Chicago, who had been secretary and treasurer of their association, was appointed manager of the industrial group department of the M. A. M. A. He has now been relieved of these duties and will return to Chicago.

No information is available as to whether the associations which were dissolved to continue the same general activities with the M. A. M. A. will be reorganized. No statement has been made by the directors of the M. A. M. A. as to the motives which prompted their decision to abandon the group plan. It is understood, however, that it was felt it would prove unwieldly. The nebulous state of the Federal law in relation to trade association activities also is believed to have had some bearing on the action.

N. A. C. C. Asks Distribution of Data in Foreign Fields

NEW YORK, March 27—The foreign trade committee of the National Automobile Chamber of Commerce has asked export managers of member companies to co-operate in the distribution abroad of information which will stimulate interest in the use of American motor vehicles. One purpose will be to familiarize foreign countries with the various utility uses to which motor vehicles are put in the United States.

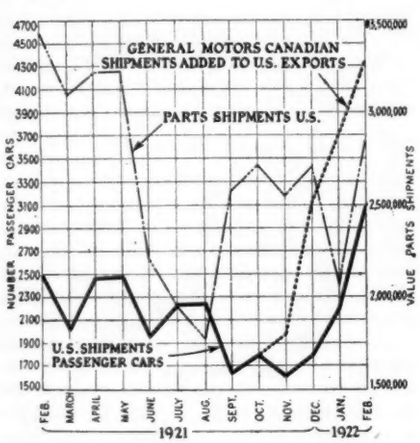
Information on road development also would prove acceptable, it is believed. This campaign will be conducted through export managers and their dealers abroad. In preparation for the work, members of the chamber have been asked to submit suggestions and lists of foreign cities in which they are represented.

International Trade Improves Materially

Total Shipments 3,550 in February Are Almost Equal to Same Month, 1921

(*Continued from page* 738)

in line with the post-war development in industry and agriculture. New orders have come through from many territories where the stocks of cars and equipment have been sold out, necessitating new purchases to meet current demands. These demands throughout most of 1921 were met by the stocks sent through immediately after the boom broke and, as these stocks have now disappeared in numerous centers, shipments are necessary to keep cars on the dealers' floors and equipment in the stockrooms and warehouses.



The upward swing of passenger car exports

Details of the February shipments are shown in an accompanying table, and the chart herewith reveals how the overseas trade is again building up to a higher volume. The month of February was notable in an upswing of exchange for practically all countries of the world, except for the former enemy and the new succession states of Europe, and the rise naturally was accompanied by heavier shipments.

Some Recessions in Exchanges

Since the month closed, some recessions have been made in these international currencies, but March is closing with most of them at or within a small percentage of the high point reached in the earlier upswing. Consequently, except for the seasonal variations that may be expected from the various buying territories, there seems little doubt but that the shipments will hold up or grow larger as the better business situation makes itself more clearly felt throughout the world.

The February shipments continue the improvement begun some months ago, as the following comparison of shipments during the last year will show:

1921	Passenger Cars	Trucks	Parts
Feb.	2,492	1,095	$3,426,517
March	2,019	606	3,097,890
April	2,469	609	3,195,734
May	2,479	462	3,204,723
June	1,964	418	2,211,528
July	2,224	339	1,952,525
Aug.	2,237	381	1,786,886
Sept.	1,631	239	2,570,860
Oct.	1,791	254	2,702,002
Nov.	1,616	226	2,546,424
Dec.	1,784	161	2,683,850
1922			
Jan.	2,407	464	2,060,619
Feb.	3,096	454	2,838,259

In addition, the General Motors group have announced the shipments from Canada of the following number of cars not shown on the U. S. totals: November 371, December, 1338 and January 1300.

Denver Dealers Survey Cost of Doing Business

DENVER, March 25—A survey of the cost of doing business in the wholesale and retail automobile and truck fields has been undertaken by the Denver Automobile Dealers Association. The survey is being conducted separately for the distributor organizations of Denver and the dealer organizations of the Rocky Mountain territory. The work is being directed by the extension division of the University of Colorado.

The university is sending to Denver distributors and Rocky Mountain dealers questionnaires covering several pages, on which they are requested to give detailed information regarding total investment, total sales for 1921, sales of used cars, parts and sundries, repair labor, etc.

Another division of the questionnaire requests information as to the relationship in percentages of total sales to the cost of salesmen's salaries, advertising, sales management, commissions, salaries, instructions and sales expense, traveling, administration, guarantee expense, etc.

Other divisions ask for information regarding administrative and fixed expenses, with a recapitulation of the percentage relationship of selling expense in every department to the sales of that department and of administrative and fixed expense to the total sales.

April Will Surpass March in Business

(*Continued from page* 732)

basis. They have learned that the agricultural districts will take a considerably larger number of vehicles than was thought possible only two or three months ago. The same is true of the export field.

Sane and intensive sales efforts are being made. Greater attention than ever before is being given to service questions and economy of operation. The industry now realizes that the buying public is "motor wise." This is an important factor when it is considered that a very substantial part of the business this year will be in replacements.

Owen Tire Insolvent, Receiver Tells Court

Files Statement Showing Assets of Company Are $713,245 and Liabilities, $987,597

CLEVELAND, March 26—The assets of the Owen Tire & Rubber Co., of this city, are placed at $713,245 and the liabilities at $987,597 in a statement filed in the United States District Court here by M. M. Scott, receiver.

More than 150 pages of claims against the company are included in the report, most of the claims being for small amounts.

The company was organized during the war and got into production when trade in the industry slumped. Before the filing of an involuntary petition for bankruptcy in the Federal Court, the company had made certain transfers of property to creditors. It was claimed these were undue preferences and that the company at the time the transfers were made was insolvent.

Referee Made Report

C. D. Friebolin, referee in bankruptcy, was made a special master and, after conducting an investigation, reported that the company was insolvent in July and August, 1921, at the time the transfers were made. He also recommended that the petition for the adjudication of the company as a bankrupt be granted.

Because of this all creditors of the company will share on equal terms in the assets of the corporation.

Among the assets listed are accounts receivable of $11,176; accounts receivable, personal, $1,000 and notes and trade acceptances of $4,000. The liabilities include, in addition to claims reaching as high a figure as $587,168, note and trade acceptances, $39,448; trade acceptances, secured, $15,000, and acceptances payable of $100,000.

Time Payment Figures Show Sales in Chicago

CHICAGO, March 27—Figures compiled by the Central Auto Finance Association of Chicago show the steady increase in the sale at retail of automobiles in Chicago and Cook County since Jan. 1. The figures are based on time sales as indicated by the number of chattel mortgages on automobiles filed with the county recorder. C. L. Wolf, secretary of the association, estimates from long study of the automobile financing business that the time sales, including truck sales, represent about 75 per cent of total sales.

The number of chattel mortgages filed by weeks ending on given dates follows: Jan. 7, 302; Jan. 14, 410; Jan. 21, 458; Jan. 28, 442; Feb. 4, 493; Feb. 11, 442; Feb. 18, 517; Feb. 25, 486; March 4, 524; March 11, 719, March 18, 873.

Wolf said that within the last few weeks the records indicate a substantial increase in the sale of trucks.

Sales in New York Far Exceeding 1921

In Cases They Triple Business—Cars Below $2,500 in Price Take Big Jump

NEW YORK, March 27—Passenger car sales in the New York territory are following a normal curve for early spring, with the March sales records running with some cars almost twice what they were in February, and with all makes substantially ahead of last month. The indications are plain that the metropolitan trade will have at least a good spring business, and there are some pointers to a larger volume than dealers anticipated when the year opened.

Fifteen makes of cars are running far ahead of all others in their price classes, and 15 others are making what might be termed good sales records. Sales in the remaining classes are low.

In the aggregate, sales in the metropolitan area for the first three months of the year will run between two and three times the total for the same period of 1921.

County Figures

New passenger cars registered in 10 counties in and around New York numbered 4806 in January and February, as compared with 2247 in the same months last year.

Registration figures compiled by Sherlock & Arnold, publishers of the Automobile Sales Analysis, largely subscribed to by dealers, may be tabulated as follows:

Cars Below $2,500	1922	1921
January	2,019	483
February	2,231	1,409
Total	4,250	1,892
Cars $2,500 and Above	**1922**	**1921**
January	283	273
February	145	210
Total	556	355

Pulcher Elected Head of Truck Association

DETROIT, March 27—Martin L. Pulcher, vice-president and general manager of the Federal Motor Truck Co., was elected president of the new National Association of Motor Truck Industries at a meeting here this week. The purpose of the association is to improve conditions existing in the motor truck industry.

H. T. Boulden, vice-president of the Selden Truck Corp., was elected first vice-president; B. A. Gramm, vice-president of Gramm-Bernstein Motor Truck Corp., second vice-president; Moie Cook, secretary of the Service Motor Truck Co., secretary; A. S. More, president, Denby Motor Truck Co., treasurer. Don F. Whitaker, former general manager of the National Association of Motor Truck Sales Managers, which is merged into the new association, is retained as manager of the new organization.

These officers, with J. W. Stephenson, vice-president of the Indiana Truck Corp.; Homer Hilton, vice-president of Winther Motors, Inc.; F. G. Elder, vice-president of the Day Elder Motors Corp. and J. E. Tracy, vice-president of the Parker Motor Truck Co., comprise the board of directors.

Files Petition Asking Receiver for Harley Co.

BOSTON, March 30—A petition asking the appointment of receivers for the Harley Co. of Springfield, manufacturer of castings, has been filed here by Frank D. Zell of Philadelphia. He also asked an injunction to prevent the company from paying out any money while the proceedings are pending. The petition asserted that the company is solvent, but that its assets are likely to be dissipated by attachments by creditors. The plant is said to be worth approximately $1,000,000.

It is stated authoritatively that the action was taken to avert attachments and the foreclosure of a mortgage for $725,000 held by the Hendee Mfg. Co. The company is said to have quick assets of more than $200,000, and that its debts, exclusive of the mortgage, do not exceed $100,000.

Announcement was made on Jan. 4 of the transfer of the Harley Co. from the Hendee company by a syndicate headed by A. W. Morris and including R. E. Northway. The consideration was said to have been $1,100,000.

Industry Expansion Wide in Canada During 1920

OTTAWA, ONT., March 27—A preliminary report covering the automotive industry for 1920 has just been issued by the Dominion Bureau of Statistics, showing that during the year there was great expansion in the industry in each of the three sections under review.

Manufacturing firms increased their output from $80,619,846 in 1919 to $101,465,846 in 1920; automotive supply and accessories from $8,571,890 to $19,361,882 and repair plants from $12,004,970 to $16,592,623 or an increase of $36,223,645 for the three sections. Total capital invested was $89,183,306.

There were 3,759 open 2-3-passenger cars constructed at a value of $3,270,319; also 67,319 open 4-7 passenger cars valued at $65,084,212; closed cars numbered 7,957 valued at $9,721,247 and chassis, 4,601 valued at $2,407,206; trucks under 1-ton, 546 valued at $535,732 and over 1-ton 9,628 estimated at $7,617,785 with 334 specials, $75,220; 4-cylinder engines numbered at 54,121 and 6-cylinder, 4,904.

ENGINEER SUES FORD

MIAMI, FLORIDA, March 30—Damages amounting to $11,000,000 are asked in a suit filed here against Henry Ford by Edward S. Huff, an electrical engineer. Huff asserts that he originated the magneto now in use on Ford cars and that he never has been paid in full for his invention.

Miniger Will Offer to Buy Auto-Lite

Proposal Is Now Being Considered by Creditors' Committees of Willys Corp.

TOLEDO, March 29—Clement O. Miniger, one of the receivers for the Willys Corp., will make an offer to the Federal court for the Electric Auto-Lite division, with plants here and at Fostoria. The amount of the bid has not been determined, but the proposal now is being considered by committees representing bank and merchandise creditors.

Miniger, who has been a vice-president of the Willys Corp. and general manager of the Electric Auto-Lite plant, probably will have several associates in the deal, but he declines to name them. Several weeks must elapse before the negotiations can be completed, as advertisement for 30 days is required under the Ohio law. Miniger now is a director in two or three companies, which are subsidiaries of Durant Motors, Inc.

The general plan for the liquidation of assets of the Willys Corp. includes the sale of the properties now being operated and later liquidation of securities owned by the corporation. The Auto-Lite division has been the most profitable of the properties owned by the Willys Corp. The liability of the division to the Willys Corp. has been fixed at $5,405,596. The division now employs about 2000 men and has made preparations to add 300. Profits from operations in February amounted to $167,206 and for January to $158,881. Cash on hand amounts to $655,636 and the net current assets to $4,129,616. The total assets are $6,573,813.

S. A. E. Hears Electric Wiring Standard Favored

BUFFALO, March 25—Standardization of electric wiring for automobiles was advocated by W. S. Haggott of the Packard Electric Co. of Detroit at a meeting of the Society of Automotive Engineers held here.

"In conformity to the general tendency to standardize motor parts," Haggott said, "it is proposed to consider plans for a standardization of the electrical wiring of different automobiles, particularly wire and cable construction and methods of installation. Two years have already been spent in designing suitable cable."

He continued to say:

The wiring of an automobile is different from the wiring in a house or a factory. Tendency is strongly toward the use of braided covered high-tension cable, the braid, being filled with a good baking varnish. It is preferable to run high-tension wire open. There is a tendency to use armored cable on lighting circuits.

The use of a main line circuit breaker is strongly advised. Standard color schemes for various circuits should be used by all manufacturers of automobile wires.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Call money was easy both at the beginning and the end of last week. On Tuesday, however, rates began to rise and held up until Friday, when the tendency was downward. This rise was attributed principally to the action of the interior banks, especially in the Middle West and Canada, in recalling funds from this center. There were also rather heavy withdrawals of Government deposits from New York banks.

The quotations for call money ranged from 3½ per cent to 5½ per cent, as compared with 3 per cent to 4 per cent in the previous week. There was no essential change in time money rates, the quotations being 4½ per cent for 60-day maturities and 4½ per cent to 4¾ per cent for 90-day and four, five and six months' maturities, as against 4½ per cent for 60 and 90-day, and 4½ per cent to 4¾ per cent for four, five and six months' in the previous week. Trading was reported as dull and featureless, and although offerings were plentiful no large transactions were recorded. Prime commercial rates were quoted at a new range, from 4½ per cent to 4¾ per cent. For the previous two weeks, the rate was 4¾ per cent, and previous to that the range of 4¾ per cent to 5 per cent had been ruling since Jan. 10.

The Federal Reserve statement as of March 22, 1922, showed an increase of $681,000 in gold reserves and $3,213,000 in total reserves. The total reserves of the New York institution increased $26,399,000 and the gold reserves $27,402,000.

The U. S. Steel Corp. is reported to be now operating at 70 per cent of capacity, and incoming business thus far in March is 30 per cent in excess of that for February. In July, 1921, operations were 29 per cent of total capacity.

On March 23 German marks reached a new low level for the year, and the lowest point in history at 29⅝ one-hundredths of a cent. This downward trend was attributed in some quarters to a feeling that recent developments in the reparations situation might react unfavorably on German finance.

G. M. Declares Dividend Upon Its Preferred Stock

NEW YORK, March 29—Directors of the General Motors Corp. at a meeting here yesterday declared the regular quarterly dividend upon the preferred and debenture stocks. The dividend on the common again was passed.

At the close of the meeting the following statement on the business outlook was made by Pierre S. duPont, president of the corporation:

The position of the corporation is very satisfactory to us. Bank loans, which now stand at $41,140,000, have been reduced $7,800,000 since the beginning of the year, and cash, which now stands at $37,000,000 decreased only $3,000,000, making a net improvement in cash position of $4,800,000.

While it may be several weeks before final figures of sales of motor cars for the first quarter of 1922 will be available, the preliminary figures are most encouraging. Sales for January were 16,080; February, 20,664 and sales for March will be approximately 30,000 cars, a total of 66,000. This compares with 58,488 cars in the previous quarter and, further, with 30,023 for the first quarter of last year.

All divisions of the corporation are enjoying a substantial increase in business, and reports from our distributors and dealers indicate a strong retail demand for our product this spring and summer.

Seek to Keep Kentucky Wagon Firm from Merger

LOUISVILLE, KY., March 29—Following the filing of two suits in Circuit Court by four minority stockholders for a receiver and for an injunction to prevent the merger, plans for the merger of the Kentucky Wagon Manufacturing Co. with several other similar plants over the country have been practically completed, it was announced to-day.

The receivership proceedings were begun by J. Hardin Ward, Wilfred Bowser and Ossian P. Ward, plaintiffs in one petition, and C. D. Karsner, plaintiff in the other. Attorneys would not say when the matter will be taken before one of the chancellors for a hearing.

The petitioners alleged that the outstanding indebtedness of the corporation, including mortgage liens, notes and other forms of indebtedness, approximate $3,450,000, while the officers of the company claim the full extent of its liabilities is only $2,600,000 and that its tangible assets total $5,000,000.

It was said that James R. Duffin, a guiding hand in the merger, is now in the East closing a deal for the transfer of the cash, and that the money will be on hand before the time expires whereby the corporation will have to make a legal reply to the petition of the stockholders.

Tractors in New England Prompt Course by College

NORWICH, CONN., March 27—Rapidly increased use of the tractor on New England farms and in the rural districts is indicated in the announcement that a brief course on the management and use of the tractor has been scheduled for this spring at the Connecticut State College at Storrs. This institution is the recognized agricultural institution of the state.

The course, to comprise two lectures daily, followed by laboratory work and augmented by practical talks by experts on oiling systems, ignition systems and the like, will be inaugurated April 11.

FORD AT SOUTHAMPTON

NEW YORK, March 30—A dispatch from Southampton, England, states that representatives of Henry Ford have agre d to purchase from the city government a site for an automobile factory to cost £500,000.

FINANCIAL NOTES

Advance Rumley Co. in its annual report for the year ended Dec. 31, 1921 shows gross profits from operations of $1,353,452 compared with $4,971,129 in 1920. After allowing for all expenses, inclusive of selling and administrative costs, bond interest and inventory adjustment, there was a net loss for the year of $1,964,215 against a net profit of $1,277,231 the year before. The loss was stated to be due solely to conditions in the agricultural districts. The company's inventories have been reduced from $10,489,972 at the close of 1920 to $6,937,004 at the close of last year. In the previous year the company wrote off inventory to the extent of $837,936 and in 1921 to the amount of $1,279,197.

Republic Motor Truck Co., Inc., consolidated balance sheet as of Dec. 31, 1921, shows cash as $260,186 against $493,281 in 1920; notes and accounts receivable, $519,909 compared with $773,878; inventories as $3,842,995 against $6,612,392; notes payable, $1,562,149 compared with $2,029,873; and accounts payable, $571,697 against $486,779.

Hupp Motor Car Corp. for the year ended Dec. 31, 1921 reports net profits of $890,278 after Federal taxes and other charges. This amount is equal to $1.59 a share on the common stock after allowing for the preferred dividends. There is outstanding $5,192,100 common stock of $10 a share par value.

Republic Motor Truck Co. committee for first mortgage and collateral trust 7 per cent serial notes has announced that the time for the deposit of notes had been extended until April 5, 1922. The noteholders' committee states that on March 21 notes to the amount of 80 per cent had been deposited with it.

McGraw Tire & Rubber Co., directors at a meeting here, decided not to do any new financing for the present. While the company lost money in February it is breaking even in March, with the prospects much better for April, judging from orders already booked.

Chicago Yellow Cab Co., Inc., has declared a monthly dividend of 60 cents a share payable April 1 to stock of record March 23, 1922. Previous payments were at the rate of $1.75 quarterly.

Empire Trust Co. has been appointed depositary for claims against Consolidated Distributors, Inc., under an agreement entered into March 10.

Reo Motor Car Co. has declared the regular quarterly dividend of 2½ per cent, payable April 1.

Motor Transport Future Is Outlined to Students

BOSTON, March 27—The prediction that 4000 specially trained men will be needed in the next ten years for service in the highway transport business, was made by F. W. Fenn, secretary of the motor truck committee of the National Automobile Chamber of Commerce, in an address before the students of the Massachusetts Institute of Technology.

Fenn said during his talk:

It is fairly certain that the next great development in this country in transportation will be therefore a national delivery service for picking up traffic at the point of origin and making delivery at the store door of the consignee. The motor truck offers the best solution of this problem in the opinion of many railroad officials.

INDUSTRIAL NOTES

International Steel Products Co. stockholders at a special meeting instructed the directors to take immediate steps looking to the disposition of the property. The company was organized in 1918 to manufacture mufflers and built a two-story modern factory. The decline in the commercial muffler market obliged the company to enter other lines, but while a fair business was done in 1921 the losses of the previous year were not overcome and stockholders declined to invest the additional funds required to maintain it as a going institution. The property will be offered for sale Saturday, April 15, at 2 p. m., at the plant offices in Hartford, Wis.

Master Tire & Rubber Co. reports that for the six months' period ending Feb. 25 it had manufactured 13,400 tires, a greater output than it has before produced in a like period. It states that these tires have met a ready sale at a reasonable profit to the company, with the profit and loss statement showing a very substantial net profit for this period. It also states that there is every reason to believe that the company will work out of its receivership with a stronger dealer organization and with its position better than ever before.

Wisconsin Castings Co., Sheboygan, Wis., has been incorporated with a capital stock of $125,000 by Harry W. Bolens, president of the Gilson Manufacturing Co., Port Washington, Wis., who recently purchased at receiver's auction the foundry and machine shop of the defunct Globe Metal Products Co. for $65,000. The Globe plant will be placed in operation as soon as readjustments and improvements can be made and will be devoted largely to manufacturing parts as well as complete farm tools and specialties.

Montana Tractor Co., Oconto, Wis., has elected John B. Chase, mayor of Oconto, president to fill the vacancy caused by the death of George Beyer. The Oconto factory was established about two and a half years ago by the concern, then located at Tyndall Park, near Chicago. Oconto stockholders gradually have taken over the ownership and have now made disposition of the Tyndall Park factory to other interests in order to concentrate production and administration at the main works in Oconto.

Starkweather-Snook Corp., Moline, Ill., has increased its capitalization from $100,000 to $200,000 with local bond houses underwriting the issue. The S. and S. shock absorber has been on the market for four years and a dozen agencies have been established from coast to coast. The new capitalization will provide facilities for the growing business and is the first move toward enlargement of the plant.

C. A. Shaler Co., Waupun, Wis., has made preliminary plans for the construction of a new plant to replace its works, destroyed by fire recently. These plans call for an ell-shaped structure, 50 x 300 and 50 x 150 ft., of brick and steel construction, with steel sash, fireproof throughout. Work will be put under way at once. The investment in buildings and machinery will be about $300,000.

Multibestos Co., Walpole, Mass., stockholders have elected C. W. Bunker treasurer of the company. The officers and executives are now as follows: Stoughton Bell, president; C. W. Bunker, treasurer and assistant to the president; T. J. Daley, secretary; T. H. Bateson, superintendent; E. C. Miner, assistant sales manager; J. Posternock, purchasing agent.

Lee Rubber & Tire Corp. re-elected directors at the annual stockholders' meeting. The company reports that its production since Jan. 1 has been at the rate of 2000 tires a day, which compares with 500 tires daily at this time a year ago. It also reports an improvement in sales.

Jelly Electrotype Battery Co., Inc., New York, has been placed in the hands of Joseph C. Bonner as receiver. The company, which manufactures storage batteries, has filed a petition in bankruptcy listing its liabilities as $52,654 and its assets $18,481.

A. J. Gillespie & Co. has been established at Cleveland for sales engineering service. The service will embrace both the executive and sales branches of industries and, in addition, direct sales representation for automotive products will be undertaken.

Oakland Motor Car Co. has changed its San Francisco distributorship into a direct factory branch with its territory including northern California and western Nevada. L. S. Shoup, formerly Oakland branch manager at Indianapolis, will be branch manager.

Laher Auto Spring Co. is contemplating the erection of a new factory at Spokane for the manufacture of automobile springs. The site for the plant has not been selected.

New Company to Make "No Ceem" Inner Tube

NEW YORK, March 27—The Corrugated Rubber Corp. has been organized to manufacture the "No Ceem" corrugated inner tube, a product which is described as being "moulded in one perfect ring oval in cross section, without splices, seams or creases." The tube is corrugated on the outside to facilitate circulation of air between the tube and shoe and to prevent sticking. Headquarters of the company will be in New York and a plant will be erected at Poughkeepsie.

The company is capitalized at $1,500,000. W. L. Fairchild, inventor of the process by which the tube will be made, will be vice-president. The Edward A. Cassidy Co., manufacturers' sales agent located in New York, will distribute the product.

Sounding Out Executives On Export Combine Plan

NEW YORK, March 25—Regional meetings of automotive executives at New York, Detroit, Chicago, Cleveland and perhaps other centers are being planned and soon will be held for consideration of the export combine under consideration by the National Automobile Chamber of Commerce.

All member companies of the N. A. C. C., as well as their foreign sales managers and other companies interested in the proposal, have been furnished a prospectus of the combine plan and the trade is quietly being sounded out concerning its possible adoption in preparation for the forthcoming meetings. Some modifications of the plan as it was originally presented last January, principally referring to the financing of international shipments, have been made in an effort to clarify it.

Promotion work in regard to the proposed combine is under the direction of a committee headed by A. S. More, president of the Denby Motor Truck Co. of Detroit, and George F. Bauer, foreign trade secretary of the Chamber.

METAL MARKETS

APPARENTLY the chief steel market interest approves of the advance in sheets which a number of independents have notified the trade would become effective April 1. Judge Elbert H. Gary's recent statement to the effect that "it will be our principle and policy to follow increases in the selling prices of others up to the point which we believe will be fair and reasonable and just to the purchasers and not any further" is interpreted to mean that the corporation's subsidiaries will shortly revise their prices upward to the levels recently announced by the independents. Brier Hill Steel Company, Wheeling Steel Products Company, and other independents who announced the advance of black sheets to 3.15c., galvanized to 4.15c. and full-finished automobile sheets to 4.50c., effective April 1, took special pains to afford to the trade every possible opportunity to place orders at the old prices, which were $3 a ton lower.

It is safe to say that the bulk of the sheet business for the second quarter has been placed at the previously prevailing figures of 3c. for black, 4c. for galvanized and 4.35c. for full-finished automobile sheets. Undoubtedly intimation of the advance has resulted in adding to the backlog of nearly all the mills. Until a representative tonnage of orders has been placed at the new prices it would be premature, however, to pass any sort of judgment on the market's tone. What has taken place so far is simply that the mills have revised their asking price on sheets upward to the extent of $3 a ton. There has been no buying at the new levels.

Of course, it will be well to bear in mind that the present movement differs from previous attempts to elevate steel prices to somewhat higher levels, in that it appears to have the full support of the leading interest. It may also be well to bear in mind that the corporation's judgment affecting price policy is always based upon a survey of the probabilities in the way of demand rather than upon sentiment. From the producer's point of view the market has turned the corner, which impression is based on the unanimity of sellers in asking higher prices. From the consumer's point of view the new prices are still on trial.

Pig Iron.—General demand is expanding. Automotive foundries continue to buy conservatively. So far the market is steady rather than strong.

Steel.—Announcement of impending advances in sheets was preceded by a $2 advance in sheet bars to $31. In this the principal corporation subsidiary, the Carnegie Steel Co., took the lead. There has been a slight let-up in specifications on strip steel by automotive buyers, especially on the hot-rolled. Orders for cold-drawn steel bars are larger, many buyers apparently believing that sooner or later the price for this product must be affected by the higher tendency of the basic product, ordinary steel bars. Somewhat more firmness is noted in the market for bolts and nuts.

Aluminum.—The undertone of the market is firmer and 17.50c. has now come to be an inside price for foreign virgin ingots, 98 to 99 per cent. American metal has been resold at 18.50c., which is also the level at which small tonnages of British ingots changed hands. The supply of German metal has somewhat increased, interests which for a time were out of the market again offering metal. Sheets are in fair demand at steady prices.

Copper.—Domestic demand is very quiet. The market is again easier.

Calendar

SHOWS

April 3-16—New York, Second Annual Electric Automobile Show, Showroom of the New York Edison Co.

FOREIGN SHOWS

March 10-July 31—Tokio, Japan, Peace Exhibition.

April 16-23—Mexico City, Annual Automobile Show, Auspices of the Automotive Division of the American Chamber of Commerce.

April 22-May 1—Prague, Czecho-Slovakia, Fourteenth International Automobile Exhibit.

May — Shanghai. Exhibition of Road Building Material.

May, 1922—Quito, Ecuador, Agricultural Exposition, celebrating Centenary of Ecuador. Automotive Section.

May 1-15 — The Hague. Automobile Show, also Airplanes and Motorboats. Secretary, Spui 185, The Hague.

May 6-21—Scheveningen, Automobile Show.

May 24-June 5—Barcelona, Spain, Automobile Show under Dealers' Direction.

May. 28-June 5—Prague. Motor Show. Hotel de Ville.

July 1-24—London (Olympia). Aircraft Exhibition.

Sept. 1922 — Rio de Janeiro, Brazil, Automobile exhibits in connection with the Brazilian Centenary Associação Automobilista Brazileria.

Sept. 15-20—The Hague. Automobile Show.

September—Buenos Aires, Argentina, Annual Exhibition, Sociedad Rural Argentina.

Oct. 12-23—London (Olympia). International Commercial Vehicle Exhibition.

November — London (Olympia). Automobile Show.

Nov. 10-Dec. 19 — Brussels. Automobile Show, Palais de la Cinquantenaire.

Nov. 29-Dec. 4—London (Olympia). Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

November—Buenos Aires, Argentina, Annual Exhibition, Automovil Club Argentino.

CONVENTIONS

April 4-5—Boston, Safety Conference, under auspices of Massachusetts Safety Council, State House.

April 20-22—Buffalo, N. Y., Sixth Annual Convention of the American Gear Manufacturers Association.

May 8-10—New York, National Association of Manufacturers.

May 10-12—Philadelphia, Ninth National Foreign Trade Convention of the National Foreign Trade Council.

May 12—New York, Annual Meeting, National Highway Traffic Association, at the Automobile Club of America.

May 16-18—Washington, D. C., Annual Meeting of the Chamber of Commerce of the United States.

June 11-15—Milwaukee, Annual International Convention of the Associated Advertising Clubs of the World.

June 19-24—Colorado Springs, Summer Meeting, Automotive Equipment Association.

June 26-July 1—Atlantic City, Twenty-fifth Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall Hotel.

August 28 - Sept. 2 — Detroit, National Safety Congress.

Sept. 18-23, 1922—Rome, Italy, Second Annual Meeting of the International Chamber of Commerce.

S. A. E. MEETINGS

Detroit, April 28, May 26.

June 20-24 — White Sulphur Springs, W. Va., 1922 Summer meeting of Society of Automotive Engineers.

Orders New Dividend for Standard Parts

With Its Payment, Creditors Will Have Received Total of 25 Per Cent

CLEVELAND, March 29 — Federal Judge D. C. Westenhaver to-day gave Receiver Frank A. Scott, of the Standard Parts Co., authority to pay creditors of the company a dividend of 5 per cent. About $500,000 will be paid to creditors of the company under this order. With the current payment the receivers will have paid creditors a total of 25 per cent, and $2,400,000 has been disbursed to holders of claims during the administration of Receiver Scott.

Scott had planned to ask the court for permission to disburse 10 per cent this time. Recent releases on contracts from customers, however, led him to cut the disbursement in half. As a result, the receiver will have $500,000 to aid in financing plant activities of the next few months.

When plans for refinancing the H. J. Walker & Co., makers of automobile motors, were announced, it was rumored that other automotive parts and accessories makers were to be helped. It is stated that Standard Parts Co. is one on the list to receive a helping hand and that important developments which will greatly strengthen the company are likely to come within the present year.

RICHELIEU TO MOVE

ASBURY PARK, N. J., March 29—Announcement is made here that the Richelieu Motor Corp. will be transferred to Rahway, where it will be operated as a unit of the United Auto Body Corp., of which Elmer H. Mohn is president. A holding corporation of the two companies has been formed, and the Richelieu car will be built for the present in the plant of the body company which will make all bodies for the automobile. The Richelieu Motor Corp. is headed by William Beckman as president and Mohn as managing director. The general sales manager is N. G. Rost, who was president of the Richelieu Motor Car Corp.

Road Accidents to Come Before Safety Meeting

BOSTON, March 27—A safety conference will be held at the State House here on April 4 and 5 under the auspices of the Massachusetts Safety Council, in co-operation with the departments of labor and industries and public safety. Wednesday afternoon will be given over to a program dealing with "Accidents on the Highway," John N. Cole, commissioner of public works, presiding. The program is as follows:

1.30—"How the Police Can Reduce Accidents," John L. Sullivan, chief of police at Pittsfield.

2.00—"Help Us Save a Hundred Lives this Year," Frank A. Goodwin, state registrar of motor vehicles.

2.25—"The Public Street as a Playground," Mrs. James D. Tillinghast.

2.50—"Educating the Jay-Walker to Become a Pedestrian," Franklin Collier, cartoonist of the Boston Herald

3.20—"Is the Automobile or Its Driver Dangerous?" David F. Butler, assistant secretary, Automobile Mutual Liability Insurance Co.

3.50—Movies.

SELLING PAN-AMERICAN CARS

DECATUR, ILL., March 25 — Edward Danner, former president of the insolvent Pan-American Motors and a receiver of the company, has been granted court permission to sell 30 cars inventoried at $1,000 for $630 each to the Woodbridge Co., Boston. The car was designed to sell to the trade for $2,000.

Year Started Well for American Bosch

In Its Annual Report, However, Corporation Shows Effects of 1921 General Slump

SPRINGFIELD, MASS., March 27—American Bosch Magneto Corp. reports that because of the new starting and lighting and battery ignition equipment, forward business has increased 35 per cent over a year ago and that unfilled orders on Jan. 1, 1922, were more than $8,500,000 as compared with $6,300,000 Jan. 1, 1921. It states that January shipments were the best in sixteen months and that improvement is expected each month from now until summer.

The corporation felt the effects of the slump in business during the past year, for although it did not lose a single account, it states in its annual report that gross business during the year was but 25 per cent of the 1920 total. Against profits of nearly $1,500,000 in that year the company had an operating loss of approximately $200,000 in 1921. Including inventory adjustments, dividends and write-off for experiments and research work, there was a net reduction in profit and loss surplus of $2,000,000.

The financial position of the company was comfortable at the end of 1921 as a result of liquidating efforts and the sale of $2,000,000 notes. Quick assets totalled $5,000,000, or nearly five times the rising $1,000,000 of liabilities. Inventories were reduced to $3,300,000, or about 25 per cent.

In his remarks to the stockholders, President A. T. Murray states that every aid is being given the Government in its investigation of the sale of the company by the alien property custodian.